



United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
West Virginia
Agricultural and Forestry
Experiment Station

Soil Survey of Pleasants and Tyler Counties West Virginia



How To Use This Soil Survey

General Soil Map

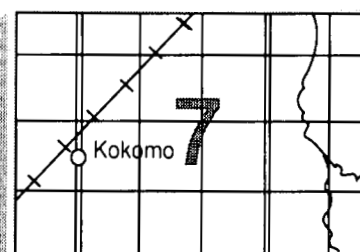
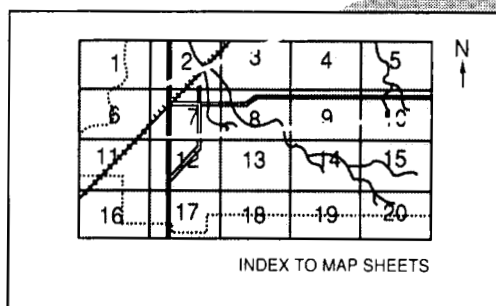
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

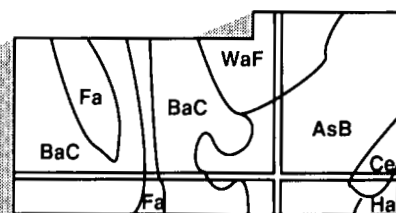
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all, regardless of race, color, national origin, sex, religion, marital status, handicap, or age.

The Soil Survey of the Parkersburg Area, West Virginia, published in 1908 (7), included Pleasants County, and the Soil Survey of the Middlebourne Area, West Virginia, published in 1907 (6), included Tyler County. The earlier information has been updated in this survey, and larger scale maps show the soils in greater detail.

Major fieldwork for this soil survey was completed in 1984. Soil names and descriptions were approved in 1984. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This survey was made cooperatively by the Soil Conservation Service and the West Virginia Agricultural and Forestry Experiment Station. The survey is part of the technical assistance furnished to the Upper Ohio Soil Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: A typical area of Moshannon silt loam on the flood plain and Gilpin-Upshur complex, 15 to 25 percent slopes, on the hillsides.

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Foreword

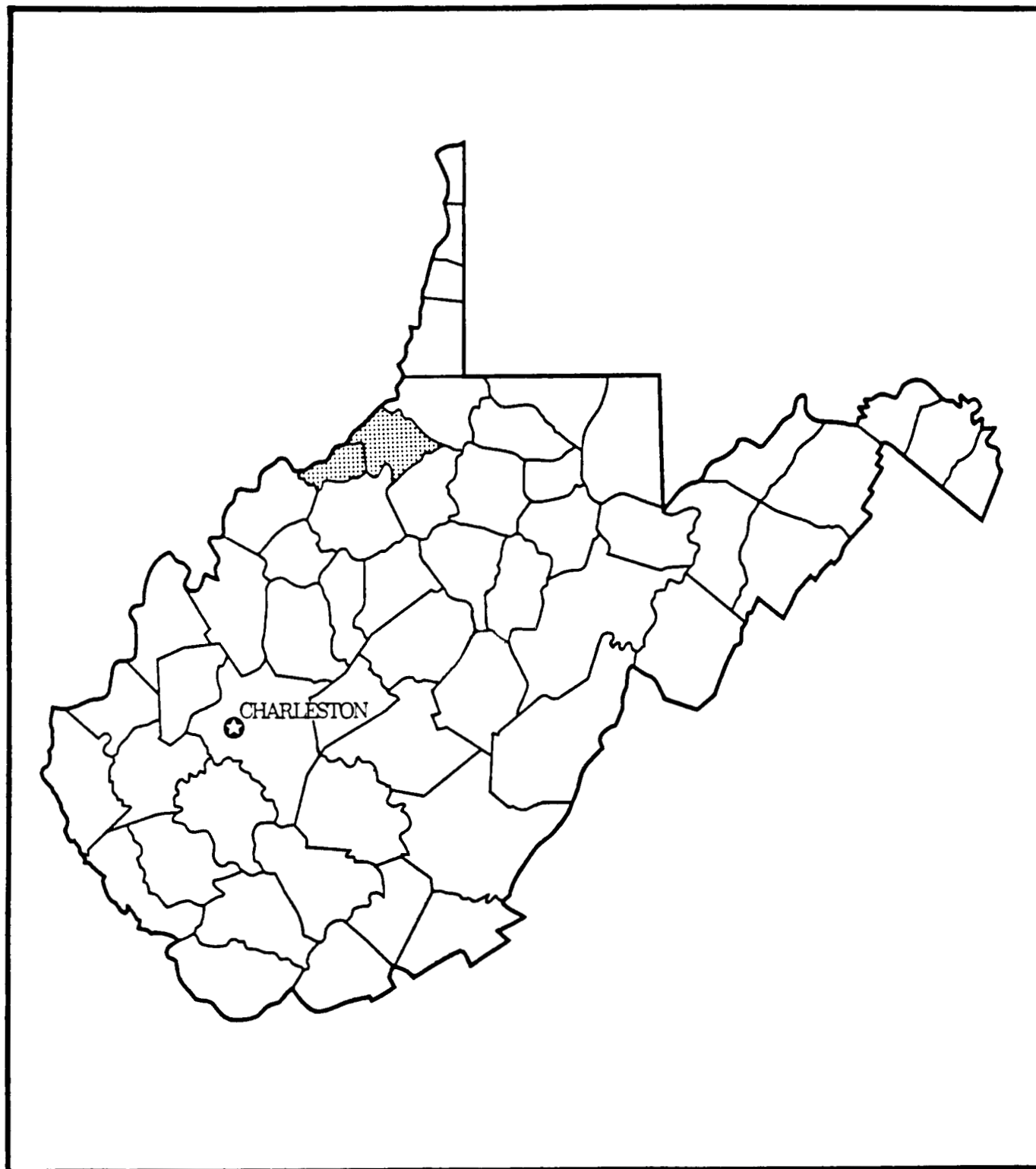
This soil survey contains information that can be used in land-planning programs in Pleasants and Tyler Counties. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Rollin N. Swank
State Conservationist
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Location of Pleasants and Tyler Counties in West Virginia.

Soil Survey of Pleasants and Tyler Counties, West Virginia

By Alex R. Topalanchik, Soil Conservation Service

Fieldwork by Alex R. Topalanchik, Claude L. Marra, and Frank A. Doonan,
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service
In cooperation with
West Virginia Agricultural and Forestry Experiment Station

PLEASANTS and TYLER COUNTIES are in the northwestern part of West Virginia. The Ohio River forms the western boundary of the survey area. Middle Island Creek enters the survey area along the southeastern part of Tyler County and empties into the Ohio River at St. Marys. The survey area takes in 392 square miles, or 250,880 acres, 6,630 acres of which are water.

General Nature of the Survey Area

This section provides information about settlement and population; farming; transportation and industry; physiography, relief, and drainage; geology; and climate in Pleasants and Tyler Counties.

Settlement and Population

The county seat of Pleasants County is St. Marys, located at the confluence of the Ohio River and Middle Island Creek. The county seat of Tyler County is Middlebourne, on Middle Island Creek.

Pleasants and Tyler Counties were established 12 and 49 years, respectively, before the formation of West Virginia in 1863.

Pleasants County was formed in 1851 from Ritchie, Tyler, and Wood Counties. It was named in honor of James Pleasants, Governor of Virginia (1822-25) and U.S. Senator. The population of Pleasants County in 1980 was 8,236.

Tyler County was formed in 1814 from Ohio County. It was named in honor of John Tyler, Governor of Virginia and father of John Tyler, 10th president of the United

States. The population of Tyler County in 1980 was 11,320.

Farming

Pleasants County had 88 farms and a total of 13,783 farm acres and Tyler County had 213 farms and a total of 43,314 farm acres, according to the 1974 Census of Agriculture (10).

Between 1969 and 1974 the number of farms decreased by 14 in Pleasants County and by 28 in Tyler County. During that period an average-size farm decreased by 40 acres in Pleasants County and by 2 acres in Tyler County.

The main farm enterprises in the survey area are raising beef cattle and producing corn, pasture, and hay. Much of the farming is done on a part-time basis by individuals who live or work in urban areas.

Transportation and Industry

Pleasants and Tyler Counties are served by a network of highways, including West Virginia Routes 2, 16, 18, 23, and 180. Rail service is provided by the Chessie System.

The counties are part of the highly industrialized Ohio River Valley. Some of the major industries in the counties are involved in the production of oil, natural gas, and chemicals and synthetics for use in making plastics and paint.

The Ohio River is a major artery in the transport of coal, other raw materials, and refined petroleum. Locks built in the Ohio River at Willow Island allow barge traffic.

Physiography, Relief, and Drainage

Pleasants and Tyler Counties are on a highly dissected plateau in the Appalachian Plateaus physiographic province. Most of the survey area is characterized by narrow ridgetops and deep, V-shaped, narrow valleys that have steep or very steep hillsides. Long, narrow, lesser sloping benches commonly separate the hillsides. Most of the flood plains are along the smaller streams. The widest flood plains and terraces are along the Ohio River and Middle Island Creek. The entire survey area drains into the Ohio River system.

The lowest elevation in the survey area is 580 feet above sea level at normal pool elevation on the Ohio River in southern Pleasants County. The highest elevation is 1,457 feet above sea level on the boundary between Tyler and Doddridge Counties about 1 1/2 miles southeast of the Alvy Post Office, in Tyler County.

Geology

Gordon B. Bayles, geologist, Soil Conservation Service, helped prepare this section.

The rock strata in Pleasants and Tyler Counties are sedimentary, and have a few gentle synclines and anticlines, but mainly lie horizontally.

Major deposition ended in the Permian Period, and since that time the region has been eroding into ridges and valleys because of major uplifting during the Appalachian orogeny.

The dominant exposed rock in the survey area is the Dunkard Group. This group has the youngest consolidated rocks in the Ohio River Valley (4). Rocks of the Monongahela and Conemaugh Groups and of the Allegheny Formation are exposed along the western flank of the Burning Springs Anticline near Vacluse, in Pleasants County. The dominant rocks in the survey area are acid, gray shale, siltstone, sandstone, and limy, red shale and siltstone. Gilpin and Upshur soils are residual soils that formed in this parent material.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Winters are cold and snowy at higher elevations in Pleasants and Tyler Counties. Winters are frequently cold in the valleys, but intermittent thaws preclude a long-lasting snow cover. Summers are fairly warm on mountain slopes and very warm and occasionally very hot in the valleys. Rainfall is evenly distributed during the year, but it is appreciably heavier on the windward, west-

facing slopes than in the valleys. Normal annual precipitation is adequate for all crops. In some years, summer temperatures and growing season length, particularly at higher elevations, are not adequate.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Bens Run, West Virginia, in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 32 degrees F, and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Bens Run on January 13, 1977, is -16 degrees. In summer the average temperature is 72 degrees, and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred at Bens Run on July 23, 1964, is 106 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 43.6 inches. Of this, 24 inches, or 55 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 20 inches. The heaviest 1-day rainfall during the period of record was 4.7 inches at Bens Run on August 4, 1960. Thunderstorms occur on about 44 days each year, and most occur in summer.

The average seasonal snowfall is 17 inches. The greatest snow depth at any one time during the period of record was 18 inches. On the average, 14 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 80 percent. Humidity is higher at night, and the average at dawn is about 55 percent. The sun shines 60 percent of the time possible in summer and 35 percent in winter. The prevailing wind is from the southwest. Average windspeed is highest, 8 miles per hour, in spring.

Heavy rains, which occur at any time of the year, and severe thunderstorms in summer sometimes cause flash flooding, particularly in narrow valleys.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed

the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material has few or no roots or other living organisms and has been changed very little by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils

were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps

because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data.

The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

Areas of the general soil map are joined with the general soil maps of Ritchie and Wood Counties, West Virginia. Differences in map unit names and proportions of component soils are caused by differences in map scale and degree of generalization.

Soil Descriptions

1. Chagrin-Wheeling-Urban land

Very deep, well drained, nearly level and gently sloping soils and Urban land; on flood plains and terraces

This map unit is mainly along the Ohio River and on islands in the Ohio River (fig. 1). Slope ranges from 0 to 8 percent.

This map unit makes up 2 percent of the survey area. It is about 23 percent Chagrin soils, 21 percent Wheeling soils, 17 percent Urban land, and 39 percent soils of minor extent.

Chagrin soils are nearly level and on flood plains. They are subject to occasional flooding in winter and spring before crops are planted. They are mostly on islands in the Ohio River, and access is limited. They formed in alluvial material washed from soils on uplands. The surface layer is dark brown and medium textured. The subsoil is brown and medium textured.

Wheeling soils are nearly level or gently sloping and on terraces. They formed in alluvial material. The surface layer is dark brown and medium textured. The subsoil is yellowish brown and medium textured.

Urban land consists of areas covered by streets, highways, parking lots, buildings, industrial complexes, schools, and other structures in urban areas. Urban land and Wheeling soils were mapped in a complex because they are in such an intricate pattern that it was not practical to separate them at the scale selected for mapping.

The minor soils in this map unit are well drained Ashton and Huntington soils, moderately well drained Lindsides soils, and poorly drained Melvin soils on flood plains; excessively drained Lakin soils on terraces and hillsides; and moderately well drained Glenford soils on terraces.

Ninety percent of the acreage of this map unit has been cleared of trees, and is used for farming or is in urban or industrial use. Most of the acreage on flood plains and on some islands in the Ohio River is used for cultivated crops. Two-thirds of the acreage on the terraces is used for cultivated crops, dominantly corn or hay, and the rest is in urban or industrial use. The major cities and industries in the survey area are located within this map unit. The wooded areas of this map unit consist of mixed hardwoods along the banks of the Ohio River, in drainageways, and in small woodlots, including some on the smaller islands.

The main management concern of the soils on flood plains for most uses is flooding. In most years flooding in late winter or early spring occurs before crops are planted. The soils on terraces have few limitations for farming and most urban uses.

2. Otwell-Gallia-Hackers

Very deep, moderately well drained and well drained, nearly level to moderately steep soils; on high flood plains and on terraces

This map unit consists of soils along Middle Island Creek and its major tributaries (fig. 2).

This map unit makes up about 4 percent of the survey area. It is about 35 percent Otwell soils, 24 percent Gallia soils, 17 percent Hackers soils, and 24 percent soils of minor extent.

Otwell soils are moderately well drained, nearly level or gently sloping, and on terraces. They formed in alluvial material washed from soils on uplands underlain by shale, siltstone, and sandstone. The surface layer is brown and medium textured. The subsoil is yellowish

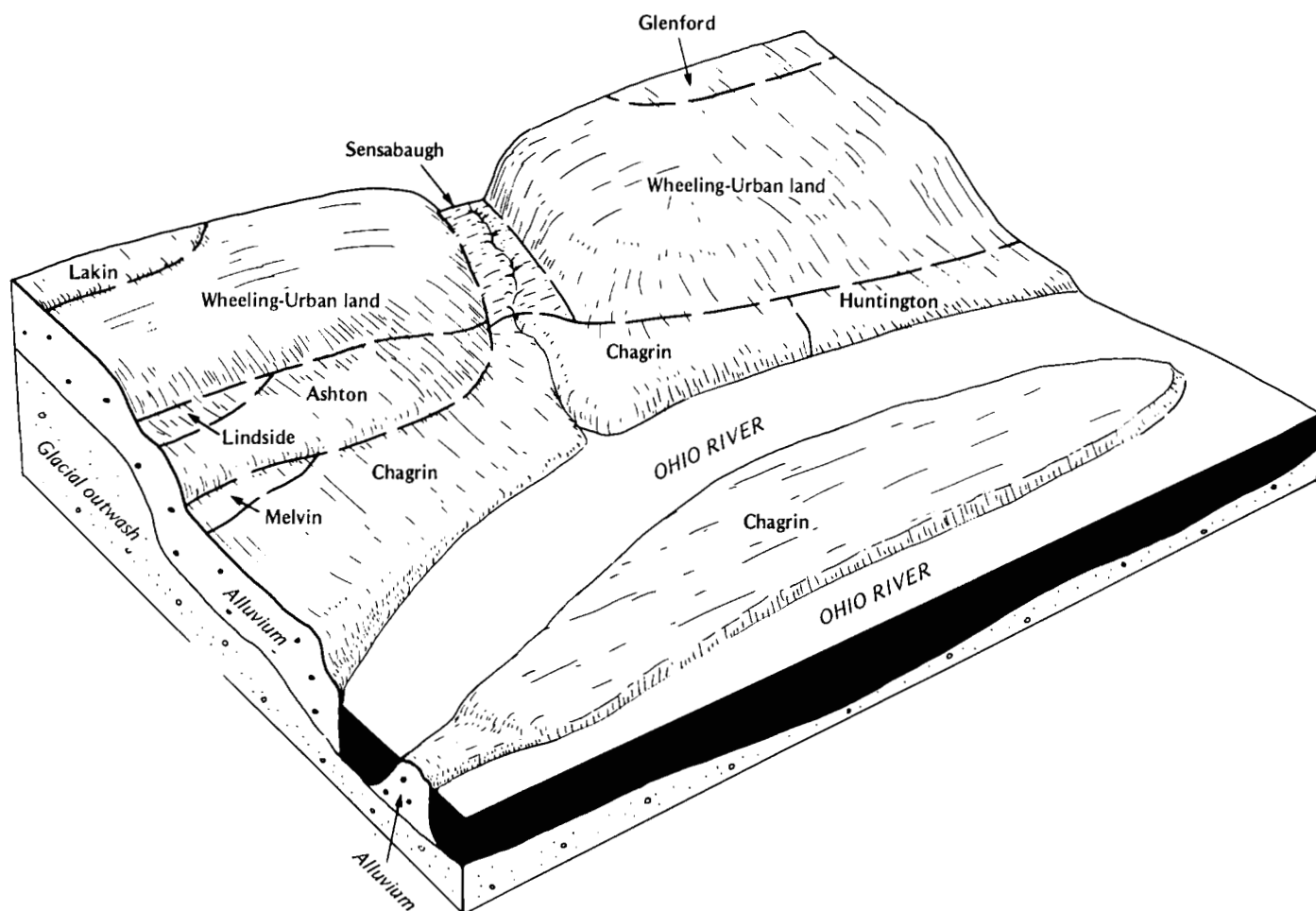


Figure 1.—Typical relationship of soils, landscapes, and underlying parent materials in Chagrin-Wheeling-Urban land general soil map unit.

brown and medium textured. In the lower part it is a mottled, very slowly permeable layer called a fragipan.

Gallia soils are well drained, strongly sloping or moderately steep, and on terraces. They formed in alluvial material washed from soils on uplands. The surface layer is dark brown and medium textured. The subsoil is strong brown and reddish brown and medium textured and moderately fine textured.

Hackers soils are well drained, nearly level or gently sloping, and on high flood plains. They are subject to rare flooding. They formed in alluvial material washed from soils on uplands. The surface layer is reddish brown and medium textured. The subsoil is reddish brown and medium textured and moderately fine textured.

The minor soils in this map unit are well drained Gilpin, Moshannon, Sensabaugh, and Upshur soils; moderately well drained Lindside soils; and poorly drained Melvin

soils on flood plains; and well drained Duncannon and Woodsfield soils on ridges.

Most areas of this map unit are farmed or idle. The rest is wooded or reverting to woodland. The main crops are corn and hay. Dairy and beef cattle are also important enterprises, and the steeper areas are used for pasture. The wooded areas consist of mixed hardwoods and volunteer and commercially planted evergreens.

The main limitations of these soils for most uses are slope, depth to the water table, and flooding. Otwell and Gallia soils are generally suited to corn and other small grains. On Hackers soils, flooding is a limitation for urban uses. Otwell and Gallia soils generally have few limitations for most urban uses.

3. Sensabaugh-Vandalla

Very deep, well drained, nearly level and moderately

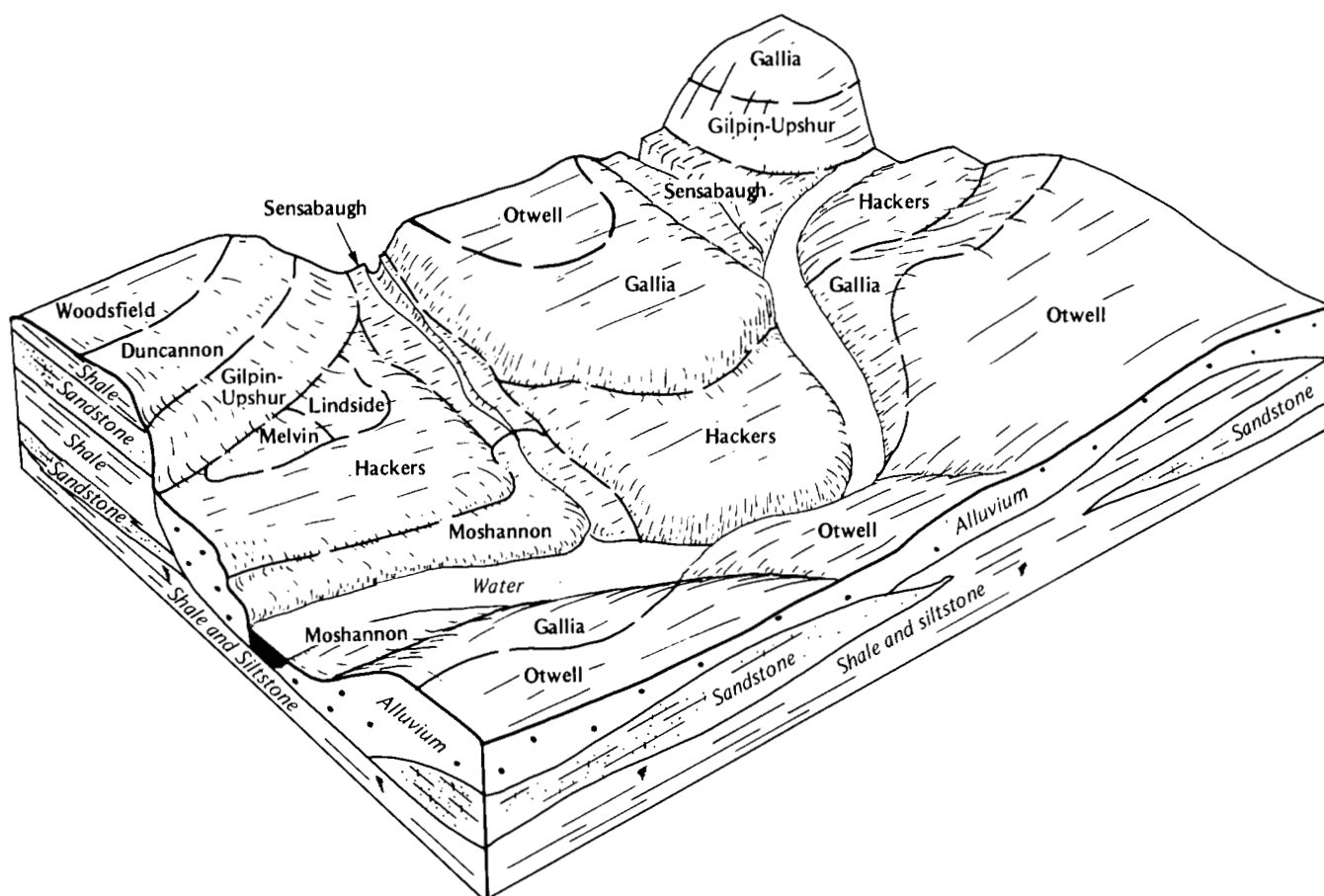


Figure 2.—Typical relationship of soils, landscapes, and underlying parent materials in Otwell-Gallia-Hackers general soil map unit.

steep soils; on flood plains and foot slopes

This map unit consists of soils along streams and on foot slopes throughout the survey area.

This map unit makes up about 8 percent of the survey area. It is about 40 percent Sensabaugh soils, 28 percent Vandalia soils, and 32 percent soils of minor extent.

Sensabaugh soils are nearly level and on flood plains. They are subject to occasional flooding. They formed in alluvial material washed from soils on uplands. The surface layer and the subsoil are dark reddish brown and medium textured.

Vandalia soils are moderately steep and on foot slopes. They formed in colluvial material that moved downslope mainly from Gilpin and Upshur soils. The surface layer is dark brown and medium textured or moderately fine textured. The subsoil is reddish brown and moderately fine textured or fine textured.

The minor soils in this map unit are well drained Chagrin and Moshannon soils on flood plains and well drained Gilpin and Upshur soils on uplands.

Most areas of this map unit are used for pasture or are idle, but some areas along streams and in drainageways are used for corn or hay. The wooded areas are dominantly mixed hardwoods.

The main limitations of these soils for most uses are flooding, slope, the slip hazard, shrinking and swelling, and moderately slow or slow permeability. On Sensabaugh soils, flooding is a limitation. On Vandalia soils, urban or farm structures are susceptible to slippage and have failed in some areas.

4. Gilpin-Upshur

Moderately deep and deep, well drained, strongly sloping to very steep soils; on uplands

This map unit is throughout the survey area. Gilpin and Upshur soils are in an intermingled pattern on the landscape.

This map unit makes up about 86 percent of the survey area. It is about 40 percent Gilpin soils, 32

percent Upshur soils, and 28 percent soils of minor extent.

Gilpin soils are moderately deep. They formed in material weathered from interbedded shale, siltstone, and sandstone. The surface layer is very dark grayish brown and medium textured. The subsoil is yellowish brown and brown and medium textured.

Upshur soils are deep. They formed in material weathered from soft, clayey shale. The surface layer is dark reddish brown and moderately fine textured. The subsoil is reddish brown and dark reddish brown and fine textured.

The minor soils in this map unit are well drained Sensabaugh, Hackers, and Moshannon soils on flood plains and well drained Vandalia soils on foot slopes.

Eighty-five percent of the acreage in this map unit is woodland or reverting to woodland. Many areas that

were formerly cleared have reseeded naturally to Virginia pine and yellow-poplar. Slope restricts the use of logging equipment. Erosion is a hazard on logging roads and trails. Some of the broader ridgetops and less sloping hillsides have been cleared and are used for hay and pasture. The narrow flood plains are generally isolated and are too small for row crop production. They are mostly used for hay or pasture.

The main limitations of these soils for most uses are slope, depth to bedrock, shrinking and swelling, the slip hazard, and clayey texture. Some of the broader ridgetops are used as sites for dwellings, but generally the soils are not suited to urban or industrial uses that require large sites. Soil slippage is common on these soils, and is a limitation in pasture and hayland as well as for urban uses.

Detailed Soil Map Units

Dr. John Sencindiver, associate professor of agronomy, West Virginia Agricultural and Forestry Experiment Station, helped prepare this section.

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the underlying material, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Vandalia silt loam, 15 to 25 percent slopes, is one of the phases in the Vandalia series.

Some map units are made up of two or more major soils. These map units are called soil complexes, soil associations, or undifferentiated groups.

A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. The Gilpin-Upshur complex, 8 to 15 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such

differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

AsA—Ashton silt loam, 0 to 3 percent slopes. This is a very deep, well drained soil on high flood plains along the Ohio River. It is subject to rare flooding.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is dark brown and extends to a depth of 55 inches. In the upper 7 inches it is silt loam, in the the next 23 inches it is silty clay loam, and in the lower 15 inches it is silt loam. The substratum is dark brown silt loam to a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of well drained Huntington, Wheeling, and Chagrin soils, moderately well drained Lindsides soils, and poorly drained Melvin soils. Also included are a few small areas of soils that have more sand throughout than is typical for Ashton soils and a few small areas of soils that have slope of 3 to 8 percent. The included soils make up about 25 percent of the map unit.

The available water capacity of this Ashton soil is high. Permeability in the subsoil is moderate. Runoff is slow or medium, and natural fertility is high. In unlimed areas the soil is moderately acid to neutral. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for cultivated crops, mainly corn (fig. 3). Some areas are used for hay and pasture. A small acreage is wooded. Flooding in late winter and early spring does not affect crop production. Cultivated crops can be grown continuously on this soil, but a cover crop is needed to control erosion. Working the residue from the cover crop into the soil helps to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates and rotation grazing to maintain desirable grasses and legumes.

Potential productivity for trees on this soil is moderately high. There are few limitations to woodland management. Most woodland is along the banks of the Ohio River and in small woodlots. These areas are generally not large enough for commercial wood production.

The main limitations of this soil for most urban uses are low soil strength, potential frost action, and flooding.

Flooding is a limitation to use of this soil as sites for dwellings and septic tank absorption fields.

Flooding, potential frost action, and low soil strength are limitations to use of this soil as sites for local roads and streets. Constructing roads and streets on raised fill over coarse grained base material helps to prevent the damaged pavement caused by these limitations.

The limitations of the included soils for most urban uses are occasional flooding on Huntington and Chagrin soils and occasional flooding and the seasonal high

water table on Melvin and Lindsides soils. The included Wheeling soils are not subject to flooding, and have few limitations for most urban uses.

The major soil is in capability class I.

AsB—Ashton silt loam, 3 to 8 percent slopes. This is a very deep, well drained soil on high flood plains along the Ohio River. It is subject to rare flooding.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is dark brown and extends to a depth of about 55 inches. In the upper 7 inches it is silt loam, in the next 23 inches it is silty clay loam, and in the lower 15 inches it is silt loam. The substratum is dark brown silt loam to a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of well drained Huntington, Wheeling, and Chagrin soils, moderately well drained Lindsides soils, and poorly



Figure 3.—Typical area of Ashton silt loam, 0 to 3 percent slopes, farmed intensively to corn.

drained Melvin soils. Also included are a few small areas of soils that have more sand throughout than is typical for Ashton soils and a few small areas of soils that have slope of 0 to 3 percent or 8 to 15 percent. The included soils make up about 25 percent of the map unit.

The available water capacity of this Ashton soil is high. Permeability in the subsoil is moderate. Runoff is medium, and natural fertility is high. In unlimed areas the soil is moderately acid to neutral. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for cultivated crops, mainly corn. Some areas are used for hay and pasture. A small acreage is wooded. Flooding in late winter and early spring does not affect crop production. Erosion is a moderate hazard in unvegetated areas. Conservation tillage, contour cultivation, a crop sequence that includes hay, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are rotation grazing and proper stocking rates to maintain desirable grasses and legumes.

Potential productivity for trees on this soil is moderately high. The soil has few limitations to woodland management. Most of the trees are along the banks of the Ohio River and in small woodlots. These wooded areas are generally not large enough for commercial wood production.

The main limitations of this soil for most urban uses are low soil strength, potential frost action, and flooding.

Flooding is a limitation to use of this soil as sites for dwellings and septic tank absorption fields.

Flooding, potential frost action, and low soil strength are limitations to use of this soil as sites for local roads and streets. Constructing roads and streets on raised fill over coarse grained base material helps to prevent the damaged pavement caused by these limitations.

The limitations of the included soils for most urban uses are occasional flooding on Huntington and Chagrin soils and occasional flooding and the seasonal high water table on Melvin and Lindsides soils. The included Wheeling soils are not subject to flooding and have few limitations for most urban uses.

The major soil is in capability subclass IIe.

CeE—Cedarcreek channery silt loam, steep, stony.

This is a very deep, well drained soil on benches, hill slopes, and out slopes of areas that have been surface mined for coal. The dominant slope range is 15 to 35 percent. Stones commonly 1 to 2 feet in diameter cover as much as 3 percent of the surface of this soil. The soil formed in mixed, partly weathered, fine earth material and fragments of sandstone, shale, mudstone, and coal. Some areas have naturally revegetated, and other areas have been reclaimed by grading and seeding. The soil is near Borland in Pleasants County.

Typically, the surface layer is strong brown channery silt loam about 8 inches thick. The substratum is

brownish yellow very channery silt loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of well drained Gilpin and Upshur soils. Also included are small areas of soils that have more mudstone and more clay in the substratum than is typical for Cedarcreek soils. Also included are areas where 18 to 30 inches of natural soil material is on the surface. In these areas the available water capacity is higher than for the Cedarcreek soil. Bedrock escarpments are included along mining highwalls. The included areas make up about 15 percent of the map unit.

The available water capacity and permeability of this Cedarcreek soil are moderate. Runoff is medium in the benched areas and rapid or very rapid on out slopes. Natural fertility is low. In unlimed areas the soil is strongly acid to extremely acid. Depth to bedrock is more than 60 inches.

Most of the acreage of this soil is woodland. It is not suited to cultivated crops, hay, or pasture.

Potential productivity for trees on this soil is moderately high. Virginia pine is common. The major management concerns are the erosion hazard and seedling mortality. The survival rate of seeds and seedlings is better if competing vegetation is controlled. Slope and bedrock escarpments along mining highwalls restrict the use of logging equipment. Constructing logging roads and skid trails close to the contour helps to control erosion. Some common trees to plant for commercial wood production are Virginia pine, eastern white pine, black locust, and European black alder.

Onsite investigation is needed to determine the limitations of this soil for urban uses. It is generally not suited to urban uses because of slope, potential differential settling, and difficulty in excavating because of stones.

The main limitation of the included soils for most urban uses is slope. In addition, other limitations are depth to bedrock on Gilpin soils and low soil strength, shrinking and swelling, slow permeability in the subsoil, and the slip hazard on Upshur soils.

The major soil is in capability subclass VIIc.

Cg—Chagrin loam. This is a very deep, well drained soil on flood plains along the Ohio River (fig. 4) and some smaller streams. It is subject to occasional flooding in most years in winter and spring before crops are planted. Slope ranges from 0 to 3 percent.

Typically, the surface layer is dark brown loam about 11 inches thick. The subsoil is brown loam about 27 inches thick. The substratum is brown sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of well drained Ashton, Hackers, Huntington, Moshannon, and Sensabaugh soils, moderately well drained Lindsides soils, and poorly drained Melvin soils. Also included are a few small areas of soils that have



Figure 4.—An area of Chagrin loam on one of the larger islands in the Ohio River.

slope of 3 to 8 percent and areas of soils that have a surface layer of fine sandy loam. Also included are soils that have a strongly acid subsoil and, in areas along Middle Island Creek and some of the smaller streams, soils that have a reddish brown substratum. Also included are soils in lower lying areas along the upstream end of the Ohio River and on the sides of islands in the Ohio River. These soils are sandier than the Chagrin soil and are subject to frequent flooding. The included soils make up 15 percent of the map unit.

The available water capacity of this Chagrin soil is high. Permeability in the subsoil is moderate. Runoff is slow, and natural fertility is high. In unlimed areas the

soil is moderately acid to neutral. Depth to bedrock is more than 60 inches.

About two-thirds of the acreage of this soil is on the islands in the Ohio River, and one-third is on the low flood plains along the Ohio River and along some of the smaller streams. Most of the islands are used as woodland or are idle because of their small size and limited access. Areas of this soil on larger islands, such as Williamson Island in Tyler County and Middle Island in Pleasants County, are intensively farmed. The main crop is corn. In some areas the soil is used for hay and pasture.

Cultivated crops can be grown continuously on this soil, but a cover crop is needed to help to control

erosion. Flooding in late winter and early spring does not affect crop production. Working the residue from the cover crop into the soil helps to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing until the soil is reasonably firm.

Potential productivity for trees on this soil is moderately high. There are few limitations to woodland management except where access is limited.

The main limitation of this soil for urban uses is flooding.

Flooding and limited access are limitations to use of this soil as sites for dwellings and septic tank absorption fields. Selecting better suited soils that are not subject to flooding overcomes the flooding limitation.

Flooding and limited access are limitations to use of this soil as sites for local roads and streets. Constructing roads and streets on raised fill material helps to prevent the damaged pavement caused by flooding.

The limitations of the included soils for most urban uses are rare flooding on Ashton and Hackers soils, occasional flooding on Huntington, Moshannon, Sensabaugh, Lindsides, and Melvin soils, and the seasonal high water table on Lindsides and Melvin soils.

The major soil is in capability subclass IIw.

DuC—Duncannon silt loam, 8 to 15 percent slopes.

This is a very deep, well drained soil mainly on loess-covered ridgetops and stream terraces along the Ohio River. Erosion has removed one-fourth to three-fourths of the original surface layer of this soil.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil is silt loam to a depth of about 52 inches. In the upper 5 inches it is yellowish brown, and in the lower 41 inches it is strong brown. The substratum is yellowish brown fine sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of well drained Gallia, Gilpin, Lakin, Upshur, and Woodsfield soils and moderately well drained Otwell soils. Also included are small areas of soils where erosion has removed most of the surface layer and the subsoil is exposed in places. Also included are small areas of soils that have slope of less than 8 percent or more than 15 percent. The included soils make up about 25 percent of this map unit.

The available water capacity of this Duncannon soil is high. Permeability in the subsoil is moderate. Runoff is rapid, and natural fertility is moderate. In unlimed areas the soil is moderately acid or strongly acid in the solum and slightly acid to strongly acid in the substratum. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for hay and pasture (fig. 5). Some areas are used for cultivated crops. A small acreage is wooded. Erosion is a severe hazard in unvegetated areas. Conservation tillage, crops grown in

contour strips, a crop rotation that includes hay, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. On pasture, a major management concern is overgrazing, which can result in severe erosion. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes and rotation grazing.

Potential productivity for trees on this soil is moderately high. Erosion is a hazard on logging roads and skid trails. Laying out roads and trails close to the contour helps to control erosion.

The main limitation of this soil for urban use is slope.

Slope is a limitation to use of this soil as sites for dwellings. Land shaping and grading help to overcome the slope limitation. Erosion is a hazard in areas that have been cleared for construction. Designing dwellings to conform to the natural slope and setting helps to minimize land shaping and to control erosion. Revegetating during or soon after construction also helps to control erosion.

Slope is the main limitation to use of this soil as sites for septic tank absorption fields. Land shaping and locating the lines of the disposal field on the contour or across the slope help to overcome this limitation.

Slope and potential frost action are the main limitations to use of this soil as sites for local roads and streets. Laying out roads and streets close to the contour helps to overcome the slope limitation. Providing coarse grained base material helps to prevent the damaged pavement caused by frost action.

Slope is the main limitation to use of the included soils as sites for dwellings, septic tank absorption fields, and local roads and streets. In addition, other limitations to these uses are depth to bedrock on Gilpin soils, low soil strength on Gallia, Upshur, and Woodsfield soils, shrinking and swelling on Woodsfield and Upshur soils, the slip hazard on Upshur soils, the seasonal high water table on Otwell soils, and poor filter on Lakin soils. The included Gallia soils have few limitations for dwellings.

The major soil is in capability subclass IIIe.

DuD—Duncannon silt loam, 15 to 25 percent slopes.

This is a very deep, well drained soil on loess-covered ridgetops and stream terraces along the Ohio River. Erosion has removed one-fourth to three-fourths of the original surface layer of this soil.

Typically, the surface layer is dark brown silt loam about 4 inches thick. The subsoil is silt loam to a depth of about 50 inches. In the upper 5 inches it is yellowish brown, and in the lower 41 inches it is strong brown. The substratum is yellowish brown fine sandy loam to a depth of 60 inches or more.

Included with this soil in mapping are small areas of well drained Gallia, Gilpin, Lakin, Upshur, and Woodsfield soils and moderately well drained Otwell soils. Also included are small areas of soils where erosion has removed most of the surface layer and where the subsoil



Figure 5.—Pasture on Duncannon silt loam, 8 to 15 percent slopes.

is exposed in places. Also included are areas of soils that have slope of less than 15 percent or more than 25 percent. The included soils make up about 25 percent of this map unit.

The available water capacity of this Duncannon soil is high. Permeability in the subsoil is moderate. Runoff is rapid, and natural fertility is moderate. In unlimed areas the soil is moderately acid or strongly acid in the solum and slightly acid to strongly acid in the substratum. Depth to bedrock is more than 60 inches.

This soil is used mainly for pasture and hay. In some areas it is suited to cultivated crops. Erosion is a severe hazard in unvegetated areas. Conservation tillage, crops grown in contour strips, a crop rotation that includes hay, shallow drainageways maintained in sod, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. On pasture, a major management concern is overgrazing, which can result in severe soil erosion. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes and rotation grazing.

Potential productivity for trees on this soil is moderately high. The main management concerns are the erosion hazard, the equipment limitation, and

seedling mortality. Seeds and seedlings survive and grow well if competing vegetation is controlled. The soil is soft when wet, and thus restricts the use of heavy equipment to dry periods. Erosion is a hazard on logging roads and skid trails. Laying out roads and trails close to the contour helps to control erosion.

The main limitation of this soil for most urban uses is slope.

Slope is a limitation to use of this soil as sites for dwellings. Land shaping and grading help to overcome this limitation. Erosion is a hazard in areas that have been cleared for construction. Designing dwellings to conform to the natural slope and setting helps to minimize land shaping and to control erosion. Revegetating during or soon after construction also helps to control erosion.

Slope is the main limitation to use of this soil as sites for septic tank absorption fields. Land shaping and locating the lines of the disposal field on the contour or across the slope helps to overcome this limitation.

Slope and potential frost action are the main limitations to use of this soil as sites for local roads and streets. Laying out roads and streets close to the

contour helps to overcome the slope limitation. Providing coarse grained base material helps to prevent the damaged pavement caused by frost action.

Slope is the main limitation to use of the included soils as sites for dwellings, septic tank absorption fields, and local roads and streets. In addition, other limitations to these uses are depth to bedrock on Gilpin soils, low soil strength on Gallia, Upshur, and Woodsfield soils, shrinking and swelling on Woodsfield and Upshur soils, the slip hazard on Upshur soils, the seasonal high water table on Otwell soils, and poor filter on Lakin soils. The included Gallia soils have few limitations for dwellings.

The major soil is in capability subclass IVe.

GaC—Gallia silt loam, 8 to 15 percent slopes. This is a very deep, well drained soil mainly on high stream terraces along the Ohio River, Middle Island Creek, and other major streams. Erosion has removed one-fourth to three-fourths of the original surface layer of the soil.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark yellowish brown silt loam to a depth of 13 inches, strong brown clay loam to a depth of 26 inches, and reddish brown clay loam to a depth of 51 inches. Below that, it is strong brown clay loam.

Included with this soil in mapping are a few small areas of well drained Duncannon, Gilpin, Upshur, and Woodsfield soils and moderately well drained Licking and Otwell soils. Also included are soils that are similar to the Gallia soil, except they have a thinner solum and are less than 60 inches deep to bedrock. Also included are some small areas of soils where erosion has removed most of the surface layer and where the subsoil is exposed in places. Also included are areas of soils that have slope of less than 8 percent or more than 15 percent. The included soils make up about 25 percent of this map unit.

The available water capacity of this Gallia soil is high. Permeability in the subsoil is moderate. Runoff is rapid, and natural fertility is low or medium. In unlimed areas the soil is strongly acid or very strongly acid. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for hay and pasture. Some areas are used for cultivated crops. A small acreage is wooded. Erosion is a severe hazard in unvegetated areas. Conservation tillage, contour cultivation, crops grown in contour strips, a crop rotation that includes hay crops, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes and rotation grazing.

Potential productivity for trees on this soil is moderately high. Erosion is a hazard on logging roads and skid trails. Laying out roads and trails near the contour helps to control erosion.

The main limitations of this soil for most urban uses are slope and low soil strength.

Slope is the main limitation to use of this soil as sites for dwellings. Land shaping and grading help to overcome the slope limitation. Erosion is a hazard in areas cleared for construction. Designing dwellings to conform to the natural slope and setting helps to minimize land shaping and to control erosion. Revegetating during or soon after construction also helps to control erosion.

Slope is the main limitation to use of this soil as sites for septic tank absorption fields. Land shaping and locating the lines of the disposal field on the contour or across the slope help to overcome this limitation.

Slope, low soil strength, and potential frost action are the main limitations to use of this soil as sites for local roads and streets. Laying out roads and streets close to the contour helps to overcome the slope limitation. Providing coarse grained base material helps to prevent the damaged pavement caused by low soil strength and frost action.

The main limitation to use of the included soils as sites for dwellings, septic tank absorption fields, and local roads and streets is slope. In addition, other limitations are depth to bedrock on Gilpin soils, low soil strength and shrinking and swelling on Upshur and Woodsfield soils, the slip hazard on Upshur soils, and the seasonal high water table on Licking and Otwell soils. The included Duncannon soils have few limitations for dwellings.

The major soil is in capability subclass IIIe.

GaD—Gallia silt loam, 15 to 25 percent slopes. This is a very deep, well drained soil on high stream terraces along the Ohio River and other major streams. Erosion has removed one-fourth to three-fourths of the original surface layer of this soil.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark yellowish brown silt loam to a depth of 13 inches, strong brown clay loam to a depth of 26 inches, and reddish brown clay loam to a depth of 51 inches. Below that, it is strong brown clay loam.

Included with this soil in mapping are a few small areas of well drained Duncannon, Gilpin, Upshur, and Woodsfield soils and moderately well drained Licking and Otwell soils. Also included are soils that are similar to the Gallia soil, except they have a thinner solum and are less than 60 inches deep to bedrock. Also included are some small areas of soils where erosion has removed most of the surface layer and where the subsoil is exposed in places. Also included are areas of soils that have slope of less than 15 percent or more than 25 percent. The included soils make up about 25 percent of this map unit.

The available water capacity of this Gallia soil is high. Permeability in the subsoil is moderate. Runoff is rapid,

and natural fertility is low or medium. In unlimed areas the soil is strongly acid or very strongly acid. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for pasture and hay. It is poorly suited to cultivated crops. Erosion is a severe hazard in unvegetated areas. Conservation tillage, crops grown in contour strips, a crop sequence that includes hay crops, maintained shallow drainageways in sod, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. On pasture, the major management concern is overgrazing, which can result in severe erosion. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes and rotation grazing.

Potential productivity for trees on this soil is moderately high. The main management concerns are the erosion hazard, the equipment limitation, and plant competition. The soil is soft when wet; consequently, the use of heavy equipment is restricted except during dry periods. Erosion is a hazard on logging roads and skid trails. Laying out roads and trails close to the contour helps to control erosion.

The main limitations of this soil as sites for most urban uses are slope and low soil strength.

Slope is the main limitation to use of this soil as sites for dwellings. Land shaping and grading help to overcome the slope limitation. Erosion is a hazard in areas cleared for construction. Designing dwellings to conform to the natural slope and setting helps to minimize land shaping and to control erosion. Revegetating during or soon after construction also helps to control erosion.

Slope is the main limitation to use of this soil as sites for septic tank absorption fields. Land shaping and locating the lines of the disposal field on the contour or across the slope help to overcome this limitation.

Slope, low soil strength, and potential frost action are the main limitations to use of this soil as sites for local roads and streets. Laying out roads and streets close to the contour helps to overcome the slope limitation. Providing coarse grained base material helps to prevent the damaged pavement caused by frost action and low soil strength.

Slope limits the use of the included soils as sites for dwellings, septic tank absorption fields, and local roads and streets. In addition, other limitations are depth to bedrock on Gilpin soils, low soil strength and shrinking and swelling on Upshur and Woodsfield soils, the slip hazard on Upshur soils, and the seasonal high water table on Licking and Otwell soils. The included Duncannon soils have few limitations for dwellings.

The major soil is in capability subclass IVE.

GpC—Gilpin-Upshur complex, 8 to 15 percent slopes. This map unit consists of well drained soils on ridgetops and benches throughout the survey area. It is about 40 percent moderately deep Gilpin soil, 40 percent

deep Upshur soil, and 20 percent other soils. Erosion has removed one-fourth to three-fourths of the original surface layer of the soils. The Gilpin and Upshur soils are in long, very narrow, contour areas in a repeating, alternating pattern. Consequently, it was not practical to separate them at the scale selected for mapping.

Typically, the surface layer of the Gilpin soil is very dark grayish brown silt loam about 3 inches thick. The subsoil extends to a depth of about 34 inches. In the upper 4 inches it is yellowish brown silt loam, in the next 14 inches it is yellowish brown channery silt loam, and in the lower 13 inches it is brown very channery silt loam. Olive brown, fine grained sandstone is at a depth of about 34 inches.

Typically, the surface layer of the Upshur soil is dark brown silty clay loam about 3 inches thick. The subsoil extends to a depth of about 43 inches. In the upper 37 inches it is reddish brown silty clay, and in the lower 6 inches it is dark reddish brown clay. Shale bedrock is at a depth of about 46 inches.

Included with these soils in mapping are a few small areas of well drained Duncannon and Woodsfield soils, a few small areas of soils that are shallower to bedrock than Gilpin and Upshur soils, areas of soils that have slope of 15 to 25 percent, and areas of soils where erosion has removed much of the surface layer and where the subsoil is exposed in places. The included soils make up about 20 percent of the map unit.

The available water capacity is moderate on the Gilpin soil and moderate or high on the Upshur soil. Permeability in the subsoil is moderate on the Gilpin soil and slow on the Upshur soil. On both soils, runoff is rapid. Natural fertility is low or medium on the Gilpin soil and medium or high on the Upshur soil. In unlimed areas the Gilpin soil is strongly acid or very strongly acid and the Upshur soil is very strongly acid to slightly acid. On the Gilpin soil, the root zone for some plants is restricted by bedrock at a depth of 20 to 40 inches. On the Upshur soil, depth to bedrock is 40 to 60 inches, shrink-swell potential in the subsoil is high, and slippage is a hazard.

In most areas these soils are used for hay and pasture. They are suited to cultivated crops. In unvegetated areas erosion is a severe hazard. Conservation tillage, crops grown in contour strips, a crop sequence that includes hay, and crop residue returned to the soils help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing until the Upshur soil is reasonably firm.

Potential productivity for trees on these soils is moderate or moderately high. On the Upshur soil, during wet seasons poor traction and low soil strength restrict the use of equipment. On both soils, erosion is a hazard on logging roads and skid trails. Laying out roads and trails close to the contour helps to control erosion.

The main limitation of these soils for most urban uses is slope. In addition, depth to bedrock is a limitation on the Gilpin soil, and shrinking and swelling, permeability, low soil strength, and the slip hazard are limitations on the Upshur soil.

The main limitation to use of these soils as sites for dwellings is slope. Land shaping and grading help to overcome the slope limitation. On the Gilpin soil, another limitation is depth to bedrock. Increased costs can be expected for excavating for and constructing dwellings with basements because of depth to bedrock. Constructing dwellings without basements is a suitable alternative. On the Upshur soil, other limitations for dwellings with basements are shrinking and swelling and the slip hazard. Wide, reinforced footers and properly designed surface and subsurface drainage to remove water from footers and foundations help to prevent shrinking and swelling. On both soils, erosion is a hazard in areas cleared for construction. Designing dwellings to conform to the natural slope and setting helps to minimize land shaping and to control erosion. Revegetating during or soon after construction also helps to control erosion.

The main limitations to use as sites for septic tank absorption fields are depth to bedrock on the Gilpin soil and slow permeability on the Upshur soil. Planning larger lots with better suited soils or using an alternate system helps to overcome these limitations.

The main limitation of these soils for local roads and streets is slope. Laying out roads and streets close to the contour helps to overcome this limitation. On the Upshur soil, other limitations are shrinking and swelling and low soil strength. Constructing roads and streets on coarse grained base material and installing collector ditches with cross culverts to remove surface water help prevent the damaged pavement caused by these limitations.

The main limitation of the included soils for most urban uses is slope. On the Woodsfield soils, other limitations are low soil strength, slow permeability, and shrinking and swelling. The included Duncannon soils have few limitations to use as sites for dwellings with basements.

The major soils are in capability subclass IIIe.

GpD—Gilpin-Upshur complex, 15 to 25 percent slopes. This map unit consists of well drained soils on ridgetops and benches throughout the survey area. Drainageways commonly dissect the benches. In some areas land slips are common. The unit is about 40 percent moderately deep Gilpin soil, 35 percent deep Upshur soil, and 25 percent other soils. Erosion has removed one-fourth to three-fourths of the original surface layer of the soils. Gilpin and Upshur soils are in long, very narrow, contour areas in a repeating, alternating pattern. Consequently, it was not practical to map them separately at the scale selected for mapping.

Typically, the surface layer of the Gilpin soil is very dark grayish brown silt loam about 3 inches thick. The subsoil extends to a depth of 33 inches. In the upper 4 inches it is yellowish brown silt loam, in the next 14 inches it is yellowish brown channery silt loam, and in the lower 12 inches it is brown very channery silt loam. Olive brown, fine grained sandstone is at a depth of about 33 inches.

Typically, the surface layer of the Upshur soil is dark brown silty clay loam about 3 inches thick. The subsoil extends to a depth of about 44 inches. In the upper 35 inches it is reddish brown silty clay, and in the lower 6 inches it is dark reddish brown clay. Shale bedrock is at a depth of about 44 inches.

Included with these soils in mapping are a few small areas of well drained Duncannon, Sensabaugh, Vandalia, and Woodland soils. Also included are a few small areas of soils that are shallower to bedrock than either the Gilpin soil or the Upshur soil, a few areas of soils where stones cover 1 to 3 percent of the surface, a few areas of escarpments, and areas of soils where erosion has removed much of the original surface layer and where the subsoil is exposed in places. The included areas make up about 25 percent of the map unit.

The available water capacity is moderate on the Gilpin soil and moderate or high on the Upshur soil. Permeability in the subsoil is moderate on the Gilpin soil and slow on the Upshur soil. On both soils, runoff is rapid. Natural fertility is low or medium on the Gilpin soil and medium or high on the Upshur soil. In unlimed areas the Gilpin soil is strongly acid or very strongly acid and the Upshur soil is very strongly acid to slightly acid. On the Gilpin soil, the root zone for some plants is restricted by bedrock at a depth of 20 to 40 inches. On the Upshur soil, depth to bedrock is 40 to 60 inches, shrink-swell potential in the subsoil is high, and slippage is a hazard.

In most areas these soils are used for hay and pasture (fig. 6). About one-third of the acreage is wooded. They are poorly suited to cultivated crops. In unvegetated areas erosion is a severe hazard. Conservation tillage, crops grown in contour strips, a crop sequence that includes hay, and crop residue returned to the soils help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing until the Upshur soil is reasonably firm.

Potential productivity for trees on these soils is moderate or moderately high. On the Upshur soil, during wet seasons poor traction and low soil strength restrict the use of equipment. Erosion is a hazard on logging roads and skid trails. Laying out roads and trails close to the contour helps to control erosion.

The main limitation of these soils for most urban uses is slope. In addition, depth to bedrock is a limitation on the Gilpin soil, and shrinking and swelling, permeability,



Figure 6.—Hay and pasture in a typical area of Gilpin-Upshur complex, 15 to 25 percent slopes.

low soil strength, and the slip hazard are limitations on the Upshur soil.

The main limitation to use of these soils as sites for dwellings is slope. Land shaping and grading help to overcome the slope limitation. On the Gilpin soil, another limitation is depth to bedrock. Increased costs can be expected for excavating for and constructing dwellings with basements because of depth to bedrock.

Constructing dwellings without basements is a suitable alternative. On the Upshur soil, other limitations are shrinking and swelling and the slip hazard. Wide, reinforced footers and properly designed surface and subsurface drainage to remove water from footers and foundations help to prevent shrinking and swelling. Diversions and tile drainage to remove surface and subsurface water from the building site and properly constructed retaining walls help to overcome the slip hazard. On both soils, erosion is a hazard in areas

cleared for construction. Designing dwellings to conform to the natural slope and setting helps to minimize land shaping and to control erosion. Revegetating during or soon after construction also helps to control erosion.

The main limitation to use of these soils as sites for septic tank absorption fields is slope. On the Gilpin soil, another limitation is depth to bedrock. On the Upshur soil, other limitations are slow permeability and the slip hazard. On both soils, laying out absorption fields on the contour and planning larger lots with better suited soils or using an alternate system helps to overcome these limitations.

The main limitation to use of these soils for local roads and streets is slope. Laying out roads and streets close to the contour helps to overcome the slope limitation. On the Upshur soil, other limitations are shrinking and swelling, slip hazard, and low soil strength. Constructing roads and streets on coarse grained base material and

installing collector ditches with cross culverts to remove surface water help to prevent the damaged pavement caused by shrinking and swelling and low soil strength.

The main limitation of the included soils for most urban uses is slope. Other limitations are occasional flooding on Sensabaugh soils, low soil strength, shrinking and swelling, and slow permeability of Woodsfield and Vandalia soils, and the slip hazard on Vandalia soils. The included Duncannon soils have few limitations for dwellings with basements.

The major soils are in capability subclass IVe.

GpE—Gilpin-Upshur complex, 25 to 35 percent slopes. This map unit consists of well drained soils on hillsides, benches, and narrow ridgetops throughout the survey area. Drainageways commonly dissect the benches. The map unit is about 40 percent moderately deep Gilpin soil, 30 percent deep Upshur soil, and 30 percent other soils. Erosion has removed one-fourth to three-fourths of the original surface layer of these soils. In some areas land slips are common. Gilpin and Upshur soils are in long, very narrow, contour areas in a repeating, alternating pattern. Consequently, it was not practical to map them separately at the scale selected for mapping.

Typically, the surface layer of the Gilpin soil is very dark grayish brown silt loam about 3 inches thick. The subsoil extends to a depth of about 31 inches. In the upper 4 inches it is yellowish brown silt loam, in the next 12 inches it is yellowish brown channery silt loam, and in the lower 12 inches it is brown very channery silt loam. Olive brown, fine grained sandstone is at a depth of about 31 inches.

Typically, the surface layer of the Upshur soil is dark brown silty clay loam about 3 inches thick. The subsoil extends to a depth of about 41 inches. In the upper 32 inches it is reddish brown silty clay, and in the lower 6 inches it is dark reddish brown clay. Shale bedrock is at a depth of about 44 inches.

Included with these soils in mapping are a few small areas of well drained Duncannon, Sensabaugh, Vandalia, and Woodsfield soils. Also included are a few small areas of soils that are shallower to bedrock than either the Gilpin soil or the Upshur soil and a few areas of soils where stones cover 1 to 3 percent of the surface. Also included are areas of soils that have slope of less than 25 percent or more than 35 percent. Also included are a few areas of escarpments and areas of soils where erosion has removed much of the original surface layer and where the subsoil is exposed in places. The included areas make up about 30 percent of this map unit.

The available water capacity is moderate on the Gilpin soil and moderate or high on the Upshur soil. Permeability in the subsoil is moderate on the Gilpin soil and slow on the Upshur soil. On both soils, runoff is very rapid. Natural fertility is low or medium on the Gilpin soil

and medium or high on the Upshur soil. In unlimed areas the Gilpin soil is strongly acid or very strongly acid and the Upshur soil is very strongly acid to slightly acid. On the Gilpin soil, the root zone of some plants is restricted by bedrock at a depth of 20 to 40 inches. Permeability in the subsoil is slow. On the Upshur soil, depth to bedrock is 40 to 60 inches, and shrink-swell potential in the subsoil is high.

One-third of the acreage of these soils is used for pasture. The rest is woodland. The soils are not suited to hay or cultivated crops. In unvegetated areas erosion is a very severe hazard. On pasture, the major management concern is overgrazing. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing until the Upshur soil is reasonably firm.

Potential productivity for trees on these soils is moderate or moderately high. On the Upshur soil, during wet seasons poor traction and low soil strength restrict the use of equipment. Erosion is a hazard on logging roads and skid trails. Laying out roads and trails close to the contour helps to control erosion. Some common trees to plant for commercial wood production are yellow-poplar, Virginia pine, and eastern white pine.

These soils are not suited to most urban uses because of slope and, in addition, depth to bedrock on the Gilpin soil and slow permeability, shrinking and swelling, low soil strength, and slip hazard on the Upshur soil. The soils are better suited to use as pasture, woodland, or as habitat for wildlife.

The main limitations of the included soils for most urban uses are occasional flooding on Sensabaugh soils, low soil strength, shrinking and swelling, and slow permeability on Woodsfield and Vandalia soils, and the slip hazard on Vandalia soils.

The major soils are in capability subclass VIe.

GpF—Gilpin-Upshur complex, 35 to 70 percent slopes. This map unit consists of well drained soils on hillsides and narrow ridgetops throughout the survey area. In many areas the landscape is characterized by a series of narrow, contour benches on hillsides. In some areas land slips are common. The unit is about 40 percent moderately deep Gilpin soil, 30 percent deep Upshur soil, and 30 percent other soils. Erosion has removed one-fourth to three-fourths of the original surface layer of these soils. Gilpin and Upshur soils are in long, very narrow, contour bodies in a repeating, alternating pattern. Consequently, it was not practical to map them separately at the scale selected for mapping.

Typically, the surface layer of the Gilpin soil is very dark grayish brown silt loam about 3 inches thick. The subsoil extends to a depth of about 30 inches. In the upper 4 inches it is yellowish brown silt loam, in the next 12 inches it is yellowish brown channery silt loam, and in the lower 11 inches it is brown very channery silt loam.

Olive brown, fine grained sandstone is at a depth of about 30 inches.

Typically, the surface layer of the Upshur soil is dark brown silty clay loam about 2 inches thick. The subsoil extends to a depth of about 40 inches. In the upper 34 inches it is reddish brown silty clay, and in the lower 4 inches it is dark reddish brown clay. Shale bedrock is at a depth of about 40 inches.

Included with these soils in mapping are a few small areas of well drained Duncannon, Sensabaugh, Vandalia, and Woodsfield soils. Also included are a few small areas of soils that are shallower to bedrock than either the Gilpin soil or the Upshur soil and a few areas of soils where stones cover 1 to 3 percent of the surface. Also included are a few areas of escarpments and areas of soils where erosion has removed most of the original surface layer and where the subsoil is exposed in places. The included areas make up about 25 percent of this map unit.

The available water capacity is moderate on the Gilpin soil and moderate or high on the Upshur soil. Permeability in the subsoil is moderate on the Gilpin soil and slow on the Upshur soil. On both soils, runoff is very rapid. Natural fertility is low or medium on the Gilpin soil and medium or high on the Upshur soil. In unlimed areas the Gilpin soil is strongly acid or very strongly acid and the Upshur soil is very strongly acid to slightly acid. On the Gilpin soil, the root zone of some plants is restricted by bedrock at a depth of 20 to 40 inches. Permeability in the subsoil is slow. On the Upshur soil, depth to bedrock is 40 to 60 inches, and shrink-swell potential in the subsoil is high.

About 90 percent of the acreage of this map unit is wooded. The rest is used as pasture. These soils are not suited to cultivated crops or hay. In unvegetated areas erosion is a very severe hazard. On pasture, the major management concern is overgrazing. The major pasture management needs are rotation grazing and deferred grazing until the Upshur soil is reasonably firm.

Potential productivity for trees on these soils is moderate or moderately high. In some areas escarpments restrict the use of equipment. On the Upshur soil, during wet seasons poor traction and low soil strength restrict the use of equipment. Erosion is a hazard on logging roads and skid trails. Laying out roads and trails close to the contour helps to control erosion. Some common trees to plant for commercial wood production are yellow-poplar, Virginia pine, and eastern white pine.

These soils are not suited to urban uses because of slope and, in addition, depth to bedrock on the Gilpin soil and slow permeability, shrinking and swelling, low soil strength, and slip hazard on the Upshur soil. The soils are better suited to use as woodland or as habitat for wildlife.

The limitations of the included soils as sites for most urban uses are occasional flooding on Sensabaugh soils,

low soil strength, shrinking and swelling, and slow permeability on Woodsfield and Vandalia soils, and the slip hazard on Vandalia soils.

The major soils are in capability subclass VIIe.

GwC3—Gilpin-Upshur complex, 8 to 15 percent slopes, severely eroded. This map unit consists of well drained soils on ridgetops and benches throughout the survey area. It is about 40 percent moderately deep Gilpin soil, 40 percent deep Upshur soil, and 20 percent other soils. Erosion has removed most of the original surface layer of these soils, and in places the subsoil is exposed. The Gilpin and Upshur soils are in long, very narrow, contour areas in a repeating, alternating pattern. Consequently, it was not practical to map them separately at the scale selected for mapping.

Typically, the surface layer of the Gilpin soil is very dark grayish brown silt loam about 2 inches thick. The subsoil extends to a depth of about 32 inches. In the upper 5 inches it is yellowish brown silt loam, in the next 12 inches it is yellowish brown channery silt loam, and in the lower 13 inches it is brown very channery silt loam. Olive brown, fine grained sandstone is at a depth of about 32 inches.

Typically, the surface layer of the Upshur soil is dark reddish brown silty clay about 2 inches thick. The subsoil extends to a depth of about 43 inches. In the upper 35 inches it is reddish brown silty clay, and in the lower 6 inches it is dark reddish brown clay. Shale bedrock is at a depth of about 43 inches.

Included with these soils in mapping are a few small areas of well drained Duncannon and Woodsfield soils. Also included are a few small areas of soils that are shallower to bedrock than either the Gilpin soil or the Upshur soil, areas of soils that have slope of 3 to 8 percent or 15 to 25 percent, and soils where most of the original surface layer has been retained. The included soils make up about 20 percent of this map unit.

The available water capacity is moderate in the Gilpin soil and moderate or high in the Upshur soil. Permeability in the subsoil is moderate in the Gilpin soil and slow in the Upshur soil. On both soils, runoff is rapid. Natural fertility is low or medium on the Gilpin soil and medium or high on the Upshur soil. In unlimed areas the Gilpin soil is strongly acid or very strongly acid. The Upshur soil is very strongly acid or slightly acid in the surface layer and the subsoil and strongly acid to slightly acid in the substratum. On the Gilpin soil, the root zone of some plants is restricted by bedrock at a depth of 20 to 40 inches. On the Upshur soil, depth to bedrock is 40 to 60 inches and shrink-swell potential in the subsoil is high.

In most areas these soils are used for hay and pasture. About one-third of the acreage is woodland. In some areas the soils are suited to cultivated crops. In unvegetated areas erosion is a very severe hazard. The loss of topsoil and of plant nutrients, poor soil tilth, and surface crusting, especially in the less sloping areas,

cause poor seed germination and low crop yields. Conservation tillage, crops grown in contour strips, a crop sequence that includes hay, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing until the Upshur soil is reasonably firm.

Potential productivity for trees on these soils is moderate or moderately high. Erosion is a very severe hazard. The loss of topsoil and of plant nutrients and in places the exposed subsoil limit seedling germination and inhibit plant growth. On the Upshur soil, during wet seasons poor traction and low soil strength restrict the use of equipment. Erosion is a hazard on logging roads and skid trails. Laying out roads and trails close to the contour helps to control erosion.

The main limitations of these soils for most urban uses are slope and, in addition, depth to bedrock on the Gilpin soil and slow permeability, shrinking and swelling low soil strength, and the slip hazard on the Upshur soil.

The main limitation to use of these soils as sites for dwellings is slope. Land shaping and grading help to overcome the slope limitation. On the Gilpin soil, another limitation is depth to bedrock. Increased costs can be expected for excavating for and constructing dwellings with basements because of depth to bedrock. Constructing dwellings without basements is a suitable alternative. On the Upshur soil, other limitations for dwellings with basements are shrinking and swelling and the slip hazard. Wide, reinforced footers and properly designed surface and subsurface drainage to remove water from footers and foundations help to prevent shrinking and swelling. On both soils, erosion is a hazard in areas cleared for construction. Designing dwellings to conform to the natural slope and setting helps to minimize land shaping and to control erosion. Revegetating during or soon after construction also helps to control erosion.

The main limitations to use as sites for septic tank absorption fields are depth to bedrock on the Gilpin soil and slow permeability on the the Upshur soil. Planning larger lots with better suited soils or the use of an alternate system helps to overcome these limitations.

The main limitation of these soils for local roads and streets is slope. Laying out roads and streets close to the contour helps to overcome this limitation. On the Upshur soil, other limitations are shrinking and swelling and low soil strength. Constructing roads and streets on coarse grained base material and installing collector ditches with cross culverts to remove surface water help to overcome these limitations.

The main limitation of the included soils for most urban uses is slope. On Woodsfield soils, other limitations to these uses are low soil strength, slow permeability, and

shrinking and swelling. Duncannon soils have few limitations to use as sites for dwellings with basements.

The major soils are in capability subclass IVe.

GWD3—Gilpin-Upshur complex, 15 to 25 percent slopes, severely eroded. This map unit consists of well drained soils on ridgetops and benches. Drainageways commonly dissect the benches. In some areas land slips are common. The map unit is about 40 percent moderately deep Gilpin soil, 35 percent deep Upshur soil, and 25 percent other soils. Erosion has removed most of the original surface layer of these soils, and in places the subsoil is exposed. The Gilpin and Upshur soils are in long, very narrow, contour areas in a repeating, alternating pattern. Consequently, it was not practical to map them separately at the scale selected for mapping.

Typically, the surface layer of the Gilpin soil is very dark grayish brown silt loam about 2 inches thick. The subsoil extends to a depth of about 31 inches. In the upper 5 inches it is yellowish brown silt loam, in the next 12 inches it is yellowish brown channery silt loam, and in the lower 12 inches it is brown very channery silt loam. Olive brown, fine grained sandstone is at a depth of about 31 inches.

Typically, the surface layer of the Upshur soil is dark reddish brown silty clay about 2 inches thick. The subsoil extends to a depth of about 42 inches. In the upper 34 inches it is reddish brown silty clay, and in the lower 6 inches it is dark reddish brown clay. Shale bedrock is at a depth of about 42 inches.

Included with these soils in mapping are a few small areas of well drained Duncannon, Sensabaugh, Vandalia, and Woodsfield soils. Also included are a few small areas of soils that are shallower to bedrock than either the Gilpin soil or the Upshur soil, areas of soils where stones cover 1 to 3 percent of the surface, areas of soils that have slope of less than 15 percent, and areas of soils that have slope of 25 to 35 percent. Also included are a few areas of escarpments and areas of soils that have most of the original surface layer. The included areas make up about 20 percent of the map unit.

The available water capacity is moderate in the Gilpin soil and moderate or high in the Upshur soil. Permeability in the subsoil is moderate on the Gilpin soil and slow on the Upshur soil. On both soils, runoff is very rapid. Natural fertility is low or medium on the Gilpin soil and medium or high on the Upshur soil. In unlimed areas the Gilpin soil is strongly acid or very strongly acid and the Upshur soil is very strongly acid to slightly acid. On the Gilpin soil, the root zone of some plants is restricted by bedrock at a depth of 20 to 40 inches. On the Upshur soil, depth to bedrock is 40 to 60 inches, in the subsoil shrink-swell potential is high, and slippage is a hazard.

One-half of the acreage is wooded. The rest is used for pasture, except a few small areas are in cultivated crops and hay. In unvegetated areas erosion is a very

severe hazard. The loss of topsoil and of plant nutrients and poor soil tilth cause poor seed germination, low crop yields, and difficulty in reestablishing hay and pasture plants. On pasture, overgrazing causes a severe hazard of erosion. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing until the Upshur soil is reasonably firm.

Potential productivity for trees on these soils is moderate or moderately high. Erosion is a very severe hazard. The loss of topsoil and of plant nutrients and the exposed subsoil in places limit seedling germination and inhibit plant growth. On the Upshur soil, during wet seasons poor traction and low soil strength restrict the use of equipment. Erosion is a hazard on logging roads and skid trails. Laying out roads and trails close to the contour helps to control erosion. Some common trees to plant for commercial wood production are yellow-poplar, Virginia pine, and eastern white pine.

The main limitation to use of these soils as sites for dwellings is slope. Land shaping and grading help to overcome the slope limitation. On the Gilpin soil, another limitation is depth to bedrock. Increased costs can be expected for excavating for and constructing dwellings with basements because of depth to bedrock.

Constructing dwellings without basements is a suitable alternative. On the Upshur soil, other limitations for dwellings with basements are shrinking and swelling and the slip hazard. Wide, reinforced footers and properly designed surface and subsurface drainage to remove water from footers and foundations help to prevent shrinking and swelling. Diversions and tile drainage to remove surface and subsurface water from the building site and properly constructed walls help to overcome the slip hazard. On both soils, erosion is a hazard in areas cleared for construction. Designing dwellings to conform to the natural slope and setting helps to minimize land shaping and to control erosion. Revegetating during or soon after construction also helps to control erosion.

The main limitation to use of these soils as sites for septic tank absorption fields is slope. On the Gilpin soil, another limitation is depth to bedrock. On the Upshur soil, other limitations are slow permeability and the slip hazard. On both soils, laying out absorption fields on the contour and planning larger lots with better suited soils or using an alternate system helps to overcome these limitations.

The main limitation to use of these soils for local roads and streets is slope. Laying out roads and streets close to the contour helps to overcome this limitation. On the Upshur soil, other limitations are shrinking and swelling, the slip hazard, and low soil strength. Constructing roads and streets on coarse grained base material and installing collector ditches with cross culverts to remove surface water help prevent the damaged pavement caused by these limitations.

The main limitation of the included soils for most urban uses is slope. In addition, other limitations to these uses are occasional flooding on Sensabaugh soils, low soil strength, shrinking and swelling, and slow permeability on Woodsfield and Vandalia soils, and the slip hazard on Vandalia soils. The included Duncannon soils have few limitations for dwellings with basements.

The major soils are in capability subclass VIe.

GwE3—Gilpin-Upshur complex, 25 to 35 percent slopes, severely eroded. This map unit consists of moderately deep and deep, well drained soils on hillsides, benches, and narrow ridgetops. Drainageways commonly dissect the benches and hillsides. In some areas land slips are common. The map unit is about 40 percent moderately deep Gilpin soil, 30 percent deep Upshur soil, and 30 percent other soils. Erosion has removed most of the original surface layer, and in places the subsoil is exposed. The Gilpin and Upshur soils are in long, very narrow, contour areas in a repeating, alternating pattern. Consequently, it was not practical to map them separately at the scale selected for mapping.

Typically, the surface layer of the Gilpin soil is very dark grayish brown silt loam about 2 inches thick. The subsoil extends to a depth of about 30 inches. In the upper 3 inches it is yellowish brown silt loam, in the next 13 inches it is yellowish brown channery silt loam, and in the lower 12 inches it is brown very channery silt loam. Olive brown, fine grained sandstone is at a depth of about 30 inches.

Typically, the surface layer of the Upshur soil is dark reddish brown silty clay about 2 inches thick. The subsoil extends to a depth of about 40 inches. In the upper 32 inches it is reddish brown silty clay, and in the lower 6 inches it is dark reddish brown clay. Shale bedrock is at a depth of about 40 inches.

Included with these soils in mapping are a few small areas of well drained Duncannon, Sensabaugh, Vandalia, and Woodsfield soils. Also included are a few small areas of soils that are shallower to bedrock than either the Gilpin soil or the Upshur soil, a few areas of soils where stones cover 1 to 3 percent of the surface, and areas of soils that have slope of less than 25 percent or more than 35 percent. Also included are a few areas of escarpments and areas of soils that have most of the original surface layer. The included areas make up about 30 percent of the map unit.

The available water capacity is moderate in the Gilpin soil and moderate or high in the Upshur soil. Permeability in the subsoil is moderate in the Gilpin soil and slow in the Upshur soil. On both soils, runoff is very rapid. Natural fertility is low or medium on the Gilpin soil and medium or high on the Upshur soil. In unlimed areas the Gilpin soil is strongly acid or very strongly acid and the Upshur soil is very strongly acid to slightly acid. On the Gilpin soil, the root zone of some plants is restricted by bedrock at a depth of 20 to 40 inches. On the Upshur

soil, depth to bedrock is 40 to 60 inches and shrink-swell potential in the subsoil is high.

These soils are not suited to cultivated crops or hay. They are difficult to manage for pasture and thus are not suited to pasture. They are best suited to use as woodland and as habitat for wildlife. One third of the acreage of these soils is woodland. About two-thirds is used for pasture. On pasture, erosion has removed the surface layer and in places the subsoil is exposed. In unvegetated areas erosion is a severe hazard. Overgrazing is a major management concern. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing until the Upshur soil is reasonably firm.

Potential productivity for trees on these soils is moderate or moderately high. In unvegetated areas erosion is a very severe hazard. Seeding bare areas to permanent cover helps to control erosion. On the Upshur soil, during wet seasons poor traction and low soil strength restrict the use of equipment. Erosion is a hazard on logging roads and skid trails. Laying out logging roads and skid trails close to the contour helps to control erosion. Some common trees to plant for commercial wood production are yellow-poplar, Virginia pine, and eastern white pine.

These soils are not suited to most urban uses. The main limitations of these soils for most urban uses are slope, depth to bedrock on the Gilpin soil, and slow permeability, shrinking and swelling, low soil strength, and slip hazard on the Upshur soil.

The main limitations of the included soils for most urban uses are occasional flooding on the Sensabaugh soils, low soil strength, high shrinking and swelling, and slow permeability of the Woodfield and Vandalia soils, and the slip hazard on the Vandalia soils.

The major soils are in capability subclass VIIe.

GxF—Gilpin-Upshur-Rock outcrop complex, 35 to 70 percent slopes. This map unit consists of well drained soils and areas of Rock outcrop. The landscape is characterized by a series of narrow, contour benches on hillsides. Land slips are common. Erosion has removed one-fourth to three-fourths of the original surface layer of the soils. The Gilpin and Upshur soils are in long, very narrow, contour bodies in a repeating, alternating pattern. Consequently, it was not practical to map them separately at the scale selected for mapping. The map unit is about 30 percent moderately deep Gilpin soil, 20 percent deep Upshur soil, 20 percent Rock outcrop, and 30 percent other soils.

Typically, the surface layer of the Gilpin soil is very dark grayish brown silt loam about 2 inches thick. The subsoil extends to a depth of about 27 inches. In the upper 4 inches it is yellowish brown silt loam, in the next 11 inches it is yellowish brown channery silt loam, and in the lower 10 inches it is brown very channery silt loam.

Olive brown, fine grained sandstone is at a depth of about 27 inches.

Typically, the surface layer of the Upshur soil is dark brown silty clay loam about 2 inches thick. The subsoil extends to a depth of about 40 inches. In the upper 34 inches it is reddish brown silty clay, and in the lower 4 inches it is dark reddish brown clay. Shale bedrock is at a depth of about 40 inches.

Rock outcrop consists of areas of vertical escarpments of sandstone and shale that follow the contour of the land. Boulders are on some benches and at the base of some slopes.

Included with these soils in mapping are small areas of well drained Vandalia soils. Also included are small areas of soils that are shallower to bedrock than typical for Gilpin and Upshur soils, a few small areas of soils where stones cover 1 to 3 percent of the surface, a few areas of soils that have slope of 25 to 35 percent, and areas of soils where erosion has removed much of the surface layer and where the subsoil has been exposed in places. The included soils make up about 40 percent of the map unit.

The available water capacity is moderate in the Gilpin soil and moderate or high in the Upshur soil. Permeability in the subsoil is moderate in the Gilpin soil and slow in the Upshur soil. On both soils, runoff is very rapid.

Natural fertility is low or medium in the Gilpin soil and medium or high in the Upshur soil. In unlimed areas the Gilpin soil is strongly acid or very strongly acid and the Upshur soil is very strongly acid to slightly acid. In the Gilpin soil, the root zone of some plants is restricted by bedrock at a depth of 20 to 40 inches. In the Upshur soil, depth to bedrock is 40 to 60 inches and shrink-swell potential in the subsoil is high.

These soils are not suited to cultivated crops, hay, or pasture. About 95 percent of the acreage of the soils is wooded.

Potential productivity for trees on these soils is moderate or moderately high. In unvegetated areas erosion is a very severe hazard. Management of these soils is very difficult. In many areas special harvesting equipment is needed because of slope and bedrock escarpments. On the Upshur soil, during wet seasons poor traction and low soil strength restrict the use of equipment. Constructing logging roads and skid trails close to the contour helps to control erosion. Some common trees to plant for commercial wood production are yellow-poplar, Virginia pine, and eastern white pine.

These soils are not suited to urban uses. They are better suited to use as woodland and as habitat for wildlife.

The main limitations of these soils for urban uses are slope, depth to bedrock on the Gilpin soil, and permeability, shrinking and swelling, low soil strength, and slip hazard on the Upshur soil.

The main limitations of the included soils for urban uses are slope and, in addition, occasional flooding on

Sensabaugh soils, low soil strength, shrinking and swelling, and slow permeability in the subsoil of Vandalia and Woodsfield soils, and the slip hazard on Vandalia soils.

The major soils are in capability subclass VII.

Gy—Glenford silt loam. This is a very deep, moderately well drained soil on stream terraces along the Ohio River. Slope ranges from 0 to 3 percent.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil extends to a depth of 55 inches. In the upper 9 inches it is yellowish brown silty clay loam that is mottled with dark brown. In the next 12 inches it is yellowish brown silty clay loam that is mottled with dark yellowish brown, brown, and light brownish gray. In the lower 27 inches it is dark yellowish brown silt loam that is mottled with brown and light brownish gray. The substratum extends to a depth of 60 inches or more. It is yellowish brown silt loam that is mottled with light brownish gray and brown.

Included with this soil in mapping are a few small areas of well drained Lakin and Wheeling soils and somewhat poorly drained Taggart soils. Also included are a few small areas of soils that have slope of 3 to 8 percent. The included soils make up about 25 percent of the map unit.

The available water capacity of this Glenford soil is high. Permeability in the subsoil is moderately slow. Runoff is slow, and natural fertility is medium. In unlimed areas the soil is strongly acid or moderately acid in the surface layer and the upper part of the subsoil and moderately acid to neutral in the lower part of the subsoil and the substratum. The seasonal high water is about 2 to 3 1/2 feet below the surface and restricts the root zone of some plants. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for hay and pasture. A small acreage is wooded. Some areas are suited to cultivated crops. Draining the small wet areas improves the suitability of this soil for cultivated crops, hay, and pasture. Cultivated crops can be grown continuously on this soil, but a cover crop is needed to help to control erosion. Working the residue from the cover crop into the soil helps to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing until the soil is reasonably firm.

Potential productivity for trees on this soil is moderately high. There are few limitations to woodland management. Most of the trees are in woodlots that generally are too small for commercial wood production.

The main limitations of this soil for most urban uses are the seasonal high water table, low soil strength, frost action, and moderately slow permeability in the subsoil.

The main limitation to use of this soil as sites for dwellings is the seasonal high water table. Installing

foundation drains and sealing foundations help to prevent wet basements.

The main limitations to use of this soil as sites for septic tank absorption fields are the seasonal high water table and moderately slow permeability in the subsoil. Special design, such as extending the length of the absorption field and using a deep, wide trench below the distribution lines, help to overcome these limitations. Selecting an alternate site with better suited soils is a suitable alternative.

The main limitations to use of this soil for local roads and streets are low soil strength, potential frost action, and the seasonal high water table. The soil is soft when wet; consequently, the pavement cracks under heavy traffic. Providing coarse grained base material helps to prevent damage to the pavement by frost action and low soil strength. Installing drainage helps to prevent damage to roads and streets by the seasonal high water table.

The limitations of the included soils for most urban uses are the seasonal high water table and low soil strength of Taggart soils and rapid permeability in the subsoil and the substratum of Lakin soils. Wheeling soils have few limitations to use as sites for dwellings.

The major soil is in capability subclass IIw.

HaA—Hackers silt loam, 0 to 3 percent slopes. This is a very deep, well drained soil on high flood plains along Middle Island Creek and other major streams.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of 44 inches. In the upper 30 inches it is reddish brown silty clay loam, and in the lower 6 inches it is yellowish red silt loam. The substratum is reddish brown silt loam to a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of well drained Chagrin, Moshannon, and Sensabaugh soils, moderately well drained Lindsides soils, and poorly drained Melvin soils. Also included are small areas of soils that have more sand in the subsoil than is typical for this Hackers soil, areas of soils that have slope of 3 to 8 percent, and some areas of Hackers soils near the mouth of Middle Island Creek that are subject to frequent flooding. The included soils make up about 25 percent of the map unit.

The available water capacity of this Hackers soil is high. Permeability in the subsoil is moderate. Runoff is slow, and natural fertility is high. In unlimed areas the soil is moderately acid or strongly acid. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for cultivated crops, mainly corn. Some areas are used for hay and pasture. A small acreage is wooded. Cultivated crops can be grown continuously on this soil, but a cover crop is needed to control erosion. Working the residue from the cover crop into the soil helps to maintain soil fertility and soil tilth. The major pasture management needs are

proper stocking rates to maintain desirable grasses and legumes and rotation grazing.

Potential productivity for trees on this soil is moderately high. There are few limitations to woodland management.

The main limitations of this soil for most urban uses are flooding and low soil strength.

Flooding restricts the use of this soil as sites for dwellings and septic tank absorption fields. Alternate sites should be selected.

Flooding and low soil strength limit the use of this soil as sites for local roads and streets. Constructing roads and streets on raised fill over coarse grained base material helps to overcome these limitations.

The main limitations of the included soils for most urban uses are occasional flooding on Chagrin, Lindsides, Melvin, Moshannon, and Sensabaugh soils and the seasonal high water table of Melvin and Lindsides soils.

The major soil is in capability class I.

HaB—Hackers silt loam, 3 to 8 percent slopes. This is a very deep, well drained soil on high flood plains along Middle Island Creek and other major streams. The soil is subject to rare flooding.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of 44 inches. In the upper 30 inches it is reddish brown silty clay loam, and in the lower 6 inches is yellowish red silt loam. The substratum extends to a depth of 60 inches or more. It is reddish brown silt loam.

Included with this soil in mapping are a few small areas of well drained Chagrin, Moshannon, and Sensabaugh soils, moderately well drained Lindsides soils, and poorly drained Melvin soils. Also included are small areas of soils that have more sand in the subsoil than is typical for the Hackers soils, areas of soils that have slope of 0 to 3 percent, and some areas of Hackers soils near the mouth of Middle Island Creek that are subject to frequent flooding. The included soils make up about 25 percent of the map unit.

The available water capacity of this Hackers soil is high. Permeability in the subsoil is moderate. Runoff is medium, and natural fertility is high. In unlimed areas the soil is moderately acid or strongly acid. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for cultivated crops, mainly corn. Some areas are used for hay and pasture. A small acreage is wooded. In unvegetated areas erosion is a moderate hazard. Conservation tillage, contour cultivation, a crop rotation that includes hay, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes and rotation grazing.

Potential productivity for trees on this soil is moderately high. There are few limitations to woodland management.

The main limitations of this soil for most urban uses are flooding and low soil strength.

Flooding restricts the use of this soil as sites for dwellings and septic tank absorption fields. Alternate sites should be selected, or dwellings should be restricted to the higher areas where the soil is subject to less frequent flooding.

The limitations to use of this soil as sites for local roads and streets are flooding and low soil strength. Constructing roads and streets on raised fill over coarse grained base material helps to overcome these limitations.

The limitations of the included soils for most urban uses are occasional flooding on Chagrin, Lindsides, Melvin, Moshannon, and Sensabaugh soils and the seasonal high water table of Melvin and Lindsides soils.

The major soil is in capability subclass IIe.

Hn—Huntington silt loam. This is a very deep, well drained soil on flood plains along the Ohio River. The soil is subject to occasional flooding, which generally occurs in late winter and early spring, before crops are planted (fig. 7). Slope ranges from 0 to 3 percent.

Typically, the surface layer is very dark grayish brown silt loam about 14 inches thick. The subsoil is dark brown silt loam about 44 inches thick. The substratum is dark brown loam to a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of well drained Ashton and Chagrin soils, moderately well drained Lindsides soils, and poorly drained Melvin soils. Also included are small areas of Huntington soils that have slope of 8 to 15 percent. Also included are small areas of Huntington soils that are upstream from the Willow Island Locks and Dam in Pleasants County and that are subject to frequent flooding. The included soils make up about 20 percent of the map unit.

The available water capacity of this Huntington soil is high. Permeability in the subsoil is moderate. Runoff is slow, and natural fertility is high. In unlimed areas the soil is slightly acid or neutral. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for cultivated crops, mainly corn. Some areas are used for hay and pasture. A small acreage is wooded. Flooding in late winter and early spring does not affect crop production. Cultivated crops can be grown continuously, but cover crops are needed to control erosion. Working the residue from the cover crop into the soil helps to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes and rotation grazing.

Potential productivity for trees on this soil is moderately high. There are few limitations to woodland



Figure 7.—Flooding in an area of Huntington silt loam.

management. Most of the trees are along the banks of the Ohio River and in small woodlots. These areas generally are not large enough for commercial wood production.

The main limitations of this soil for most urban uses are flooding, low soil strength, and potential frost action.

Flooding limits the use of this soil as sites for dwellings and septic tank absorption fields. Alternate sites should be selected.

Flooding, low soil strength, and frost action are limitations to use of this soil as sites for local roads and streets. Constructing roads and streets on raised fill over coarse grained base material helps to overcome these limitations.

The main limitations of the included soils as sites for most urban uses are rare flooding on Ashton soils, occasional flooding on Chagrin, Lindside, and Melvin soils, and the seasonal high water table of Lindside and Melvin soils.

The major soil is in capability subclass IIw.

LaC—Lakin loamy fine sand, 8 to 15 percent slopes. This is a very deep, excessively drained soil that formed in sandy material deposited by wind or water. This soil is in dune-like deposits on stream terraces and adjacent hillsides near the Ohio River.

Typically, the surface layer is dark brown and dark yellowish brown loamy fine sand about 10 inches thick.

The subsurface layer is yellowish brown loamy fine sand about 11 inches thick. The subsoil extends to a depth of 60 inches or more. In the upper 33 inches it is yellowish brown loamy fine sand that has a few horizontal layers of strong brown sandy loam. In the lower 4 inches it is yellowish brown sand that has a few horizontal layers of strong brown loamy sand.

Included with this soil in mapping are a few small areas of well drained Duncannon and Wheeling soils, moderately well drained Glenford soils, and somewhat poorly drained Taggart soils. Also included are a few small areas of soils that have slope of less than 8 percent or slope of 15 to 25 percent. Most areas of the Lakin soils that have slope of more than 15 percent are along Bull Creek in Pleasants County.

The available water capacity of this Lakin soil is low. Permeability in the subsoil is rapid. Runoff is medium, and natural fertility is medium. In unlimed areas the soil is moderately acid or strongly acid. Depth to bedrock is more than 60 inches.

About two-thirds of the acreage of this soil is used for hay and pasture. About one-third of the acreage is wooded. Some areas are used for cultivated crops. In unvegetated areas erosion is a severe hazard.

Conservation tillage, crops grown in contour strips, crop rotation that includes hay, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes and rotation grazing.

Potential productivity for trees on this soil is moderate. The main management concerns are the erosion hazard, the equipment limitation, and seedling mortality. Seeds and seedlings survive and grow well if competing vegetation is controlled and if soil moisture is adequate. The soil is soft when wet. Erosion is a hazard on logging roads and skid trails. Laying out roads and trails close to the contour and keeping the grade to a minimum help to control erosion.

The main limitations of this soil for urban uses are slope, seepage, and poor filter.

Slope is the main limitation to use of this soil as sites for dwellings. Excavating for foundations, though not difficult, is hazardous because walls of vertical cuts can collapse. Land shaping and grading help to overcome the slope limitation. Lawns are difficult to establish and maintain because of droughtiness. Increasing the organic matter content helps to increase the water-holding capacity of the soil. Erosion is a hazard in areas cleared for construction. Designing dwellings to conform to the natural slope and setting helps to minimize landshaping and to control erosion. Revegetating during or soon after construction also helps to control erosion.

Seepage and poor filter are the main limitations to use of this soil as sites for septic tank absorption fields. Both limitations can cause ground water contamination.

Slope is the main limitation to use of this soil for local roads and streets. Laying out roads and streets close to the contour helps to overcome the slope limitation.

The limitations to use of the included Glenford and Taggart soils as sites for dwellings, septic tank absorption fields, and local roads and streets are the seasonal high water table and low soil strength. In the steeper areas of the included Lakin soils, a limitation to these uses is slope. Duncannon and Wheeling soils have few limitations to use as sites for dwellings.

The major soil is in capability subclass IVs.

LkC—Licking silt loam, 8 to 15 percent slopes. This is a very deep, moderately well drained soil on stream terraces along Middle Island Creek. Erosion has removed one-fourth to three-fourths of the original surface layer of this soil.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The subsoil extends to a depth of 54 inches. It is dark yellowish brown silty clay loam to a depth of 15 inches and brown silty clay loam mottled with light brownish gray and strong brown, to a depth of 20 inches. Below that, it is reddish brown silty clay mottled with pinkish gray, strong brown, and light gray to a depth of 41 inches. Below that, it is pinkish gray clay mottled with light gray and strong brown. The substratum extends to a depth of 60 inches or more. It is reddish brown clay mottled with light gray and red.

Included with this soil in mapping are a few small areas of well drained Duncannon, Gallia, and Woodfield soils and moderately well drained Otwell soils. Also included are some areas of somewhat poorly drained and poorly drained soils and soils that have slope of less than 8 percent or more than 15 percent. The included soils make up about 20 percent of the map unit.

The available water capacity of this Licking soil is high. Permeability in the subsoil is slow. Runoff is rapid and natural fertility is medium. In unlimed areas the soil is very strongly acid to moderately acid in the surface layer and in the upper part of the subsoil. It is slightly acid or neutral in the lower part of the subsoil and in the substratum. The seasonal high water table is about 2 to 3 1/2 feet below the surface; it restricts the root zone of some plants. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for hay and pasture. Some areas are used for cultivated crops. A small acreage is wooded. Conservation tillage, crops grown in contour strips, a crop sequence that includes hay, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing in spring until the soil is reasonably firm.

Potential productivity for trees on this soil is moderately high. During wet seasons, poor traction and low soil strength restrict the use of equipment. Erosion is

a hazard on logging roads and skid trails. Laying out roads and trails close to the contour helps to control erosion.

The main limitations of this soil for most urban uses are slope, the seasonal high water table, shrinking and swelling, low soil strength, and frost action.

Slope, the seasonal high water table, and shrinking and swelling are the main limitations to use of this soil as sites for dwellings. Land shaping and grading help to overcome the slope limitation. Installing foundation drains and sealing foundations help to prevent wet basements caused by the seasonal high water table. Reinforcing footers and foundations and backfilling with sandy material help to prevent shrinking and swelling. Erosion is a hazard in areas cleared for construction. Designing dwellings to conform to the natural slope and setting helps to minimize landshaping and to control erosion. Revegetating during or soon after construction also helps to control erosion.

Slope, the seasonal high water table, and slow permeability in the subsoil are limitations to use of this soil as sites for septic tank absorption fields. Special designs, such as extending the length of the absorption field and digging a wide, deep trench below the distribution lines, help to overcome the effects of the seasonal high water table and slow permeability. Land shaping and laying out the lines of the disposal field on the contour help to overcome the slope limitation.

Slope, the seasonal high water table, low soil strength, and potential frost action are limitations to use of this soil for local roads and streets. The soil is soft when wet; consequently, pavement cracks under heavy traffic. Providing coarse grained base material helps to prevent the damaged pavement caused by low soil strength and frost action. Laying out roads and streets close to the contour helps to overcome the slope limitation. Installing subsurface drainage helps to prevent damage to roads and streets caused by the seasonal high water table.

The limitations to use of the included soils as sites for dwellings, septic tank absorption fields, and local roads and streets are the seasonal high water table of Otwell soils and low soil strength, shrinking and swelling, and slow permeability of Woodsfield soils. Gallia and Duncannon soils have few limitations for dwellings.

The major soil is in capability subclass IVe.

Ln—Lindside silt loam. This is a very deep, moderately well drained soil on flood plains of streams throughout the survey area. The soil is subject to occasional flooding. Slope ranges from 0 to 3 percent.

Typically, the surface layer is dark brown silt loam about 11 inches thick. The subsoil extends to a depth of 45 inches. In the upper 7 inches it is brown silt loam, and in the lower 27 inches it is yellowish brown silt loam mottled with grayish brown and strong brown. The substratum extends to a depth of 60 inches or more. It is brown silty clay loam mottled with grayish brown.

Included with this soil in mapping are a few small areas of well drained Ashton, Sensabaugh, Hackers, Chagrin, Huntington, and Moshannon soils and poorly drained Melvin soils. Also included are a few small areas of soils that have slope of 3 to 8 percent. The included soils make up about 15 percent of this map unit.

The available water capacity of this Lindside soil is high. Permeability in the subsoil is moderate. Runoff is slow, and natural fertility is high. In unlimed areas the soil is moderately acid to neutral. The seasonal high water table is about 1 1/2 to 3 feet below the surface, and restricts the root zone of some plants. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for hay and pasture. Some areas are used for cultivated crops. A small acreage is wooded. Draining small wet areas improves the suitability of the soil for cultivated crops, hay, and pasture. Cultivated crops can be grown continuously on this soil, but a cover crop is needed to help to control erosion. Working the residue from the cover crop into the soil helps to maintain soil fertility and soil tilth. In places crops are subject to damage from flooding. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing in spring until the soil is reasonably firm.

Potential productivity for trees on this soil is moderately high. There are few limitations to woodland management. Most of the trees are in woodlots that generally are too small for commercial wood production.

The main limitations of this soil for most urban uses are flooding, low soil strength, and the seasonal high water table.

Flooding and the seasonal high water table are limitations to use of this soil as sites for dwellings. Installing footer and foundation drains helps to prevent wet basements caused by the seasonal high water table.

Flooding and the seasonal high water table are limitations to use of this soil as sites for septic tank absorption fields. A suitable management practice is selecting alternate sites where the soils are not subject to flooding.

Flooding, low soil strength, and the seasonal high water table are limitations to use of this soil for local roads and streets. The soil is soft when wet; consequently, pavement cracks under heavy traffic. Constructing roads and streets on raised fill over coarse grained base material helps to prevent the damaged pavement caused by flooding and low soil strength. Installing drainage helps to prevent the damaged pavement caused by the seasonal high water table.

The limitations of the included soils for most urban uses are rare flooding on Ashton and Hackers soils, occasional flooding on Huntington, Moshannon, Chagrin, Sensabaugh, and Melvin soils, and the seasonal high water table of Melvin soils.

The major soil is in capability subclass IIw.

Me—Melvin silt loam. This is a very deep, poorly drained soil on flood plains along the Ohio River and Middle Island Creek. The soil is subject to occasional flooding. Slope is generally less than 2 percent.

Typically, the surface layer consists of dark grayish brown silt loam about 4 inches thick and dark brown silt loam about 5 inches thick. The subsoil is about 27 inches thick. It is light brownish gray silt loam mottled with gray and strong brown. The substratum extends to a depth of 60 inches or more. It is grayish brown silt loam mottled with gray and strong brown.

Included with this soil in mapping are small areas of well drained Ashton, Chagrin, Hackers, Huntington, Moshannon, and Sensabaugh soils and moderately well drained Lindsides soils. The included soils make up about 20 percent of this map unit.

The available water capacity of this Melvin soil is high. Permeability is moderate. Runoff is slow, and natural fertility is medium or high. In unlimed areas the soil is slightly acid or neutral. The seasonal high water table is at or near the surface, and restricts the root zone of many types of plants. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for hay and water-tolerant pasture plants. A small acreage is wooded. Artificial drainage is needed for cultivated crops, hay, and pasture. In most areas suitable drainage outlets are not available. In places diversions help to intercept runoff from higher areas. Conservation tillage, crop rotation that includes hay, tillage delayed until the soil is reasonably dry, and crop residue returned to the soil help to maintain soil fertility and soil tilth. In some areas used for cultivated crops flooding is a hazard. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, water-tolerant pasture plants, rotation grazing, and deferred grazing until the soil is reasonably firm.

Potential productivity for water-tolerant trees on this soil is moderately high. The main management concerns are the equipment limitation, seedling mortality, and plant competition. Another management concern is low soil strength; consequently, the use of heavy equipment is restricted to periods when the soil is dry. Water-tolerant seedlings survive and grow well if competing vegetation is controlled.

Flooding, the seasonal high water table, potential frost action, and low soil strength are the main limitations of this soil for urban uses.

Flooding, the seasonal high water table, potential frost action, and low soil strength are limitations to use of this soil as sites for dwellings, septic tank absorption fields, and local roads and streets.

The limitations of the included soils for most urban uses are rare flooding on Ashton and Hackers soils, occasional flooding on Chagrin, Huntington, Lindsides, Moshannon, and Sensabaugh soils, and the seasonal high water table of Lindsides soils.

The major soil is in capability subclass IIIw.

Mo—Moshannon silt loam. This is a very deep, well drained soil on flood plains along the larger streams. It is subject to occasional flooding. Slope ranges from 0 to 3 percent.

Typically, the surface layer is reddish brown silt loam about 6 inches thick. The subsoil is reddish brown silt loam about 32 inches thick. The substratum is reddish brown and extends to a depth of 60 inches or more. In the upper 19 inches it is silt loam, and in the lower 3 inches it is stratified loam, fine sandy loam, and silt loam.

Included with this soil in mapping are small areas of well drained Chagrin, Hackers, and Sensabaugh soils, moderately well drained Lindsides soils, and poorly drained Melvin soils. Also included are a few areas of soils along Middle Island Creek that are more acid in the subsoil than is typical for the Moshannon soil. The included soils make up about 20 percent of the map unit.

The available water capacity of this Moshannon soil is high. Permeability is moderate. Runoff is slow, and natural fertility is high. In unlimed areas the soil is slightly acid or moderately acid. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for cultivated crops, mainly corn. Some areas are used for hay and pasture. A small acreage is wooded. Cultivated crops can be grown continuously on this soil, but a cover crop is needed to help to control erosion. Working the residue from the cover crop into the soil helps to maintain soil fertility and soil tilth. In some places used for crops flooding is a hazard. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing in spring until the soil is reasonably firm.

Potential productivity for trees on this soil is moderately high. The main management concern is low soil strength during wet seasons. Consequently, the use of heavy equipment is restricted to periods when the soil is dry.

The main limitations of this soil for most urban uses are flooding and frost action.

Flooding is a limitation to use of this soil as sites for dwellings and septic tank absorption fields.

Flooding and frost action are limitations to use of this soil as sites for local roads and streets. Constructing roads and streets on raised fill over coarse grained base material helps prevent damage to the pavement by flooding.

The main limitations of the included soils for most urban uses are rare flooding on Hackers soils, occasional flooding of Chagrin, Lindsides, Melvin, and Sensabaugh soils, and the seasonal high water table of Lindsides and Melvin soils.

The major soil is in capability subclass IIw.

OtA—Otwell silt loam, 0 to 3 percent slopes. This is a very deep, moderately well drained soil on stream terraces mostly along Middle Island Creek.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of 60 inches or more, and in the lower 33 inches it is a firm and brittle layer called a fragipan. In the upper 18 inches it is yellowish brown silt loam, and in the next 25 inches it is yellowish brown silt loam mottled with light brownish gray. In the lower 8 inches it is yellowish brown silty clay loam mottled with strong brown and light brownish gray.

Included with these soils in mapping are small areas of well drained Gallia, Duncannon, and Woodsfield soils and moderately well drained Licking soils. Also included are small areas of somewhat poorly drained soils and small areas of soils that have slope of more than 3 percent but less than 15 percent. The included soils make up about 25 percent of the map unit.

The available water capacity of this Otwell soil is moderate. Permeability is slow above the fragipan and very slow in the fragipan. Runoff is slow, and natural fertility is low or medium. In unlimed areas the soil is moderately acid to very strongly acid. The seasonal high water table is about 2 to 3 1/2 feet below the surface, and this and the fragipan restrict the root zone of deep-rooted plants. Depth to bedrock is more than 60 inches.

In most areas this soil is used for cultivated crops, mainly corn. A small acreage is wooded. The soil is suited to hay and pasture. Cultivated crops can be grown continuously on this soil, but a cover crop is needed to help to control erosion. Working the residue from the cover crop into the soil helps to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing in spring until the soil is reasonably firm.

Potential productivity for trees on this soil is moderate. There are few limitations to woodland management. Seedlings survive and grow well if competing vegetation is controlled. In areas reverting to woodland, the dominant tree species is Virginia pine.

The main limitations of this soil for most urban uses are the seasonal high water table, low soil strength, very slow permeability, and potential frost action.

The seasonal high water table is a limitation to use of this soil as sites for dwellings. Installing foundation drains and sealing foundations help to prevent wet basements caused by the seasonal high water table. Erosion is a hazard in areas cleared for construction. Revegetating during or soon after construction helps to control erosion.

The seasonal high water table and very slow permeability in the subsoil are limitations to use of this soil as sites for septic tank absorption fields. Special designs, such as extending the length of the absorption field and digging wide, deep trenches below the distribution lines, help to overcome these limitations.

The seasonal high water table, low soil strength, and potential frost action are limitations to use of this soil for local roads and streets. The soil is soft when wet; consequently, pavement cracks under heavy traffic. Constructing roads and streets on coarse grained base material helps to prevent the damaged pavement caused by low soil strength and frost action. Installing subsurface drainage helps to prevent damage to roads and streets caused by the seasonal high water table.

The main limitations of the included soils for most urban uses are low soil strength, shrinking and swelling, and slow permeability in the subsoil on Licking and Woodsfield soils. Also on Licking soils, another limitation to most urban uses is the seasonal high water table. Gallia and Duncannon soils have few limitations for dwellings.

The major soil is in capability subclass IIw.

OtB—Otwell silt loam, 3 to 8 percent slopes. This is a very deep, moderately well drained soil on stream terraces along major streams.

Typically, the surface layer is brown silt loam about 9 inches thick. The subsoil extends to a depth of 60 inches or more, and in the lower 33 inches it is a firm and brittle layer called a fragipan. In the upper 18 inches it is yellowish brown silt loam, and in the next 25 inches it is yellowish brown silt loam mottled with light brownish gray. In the lower 8 inches it is yellowish brown silty clay loam mottled with strong brown and light brownish gray.

Included with these soils in mapping are small areas of well drained Duncannon, Gallia, and Woodsfield soils and moderately well drained Licking soils. Also included are small areas of somewhat poorly drained soils and small areas of soils that have slope of less than 3 percent or slope of 8 to 15 percent. The included soils make up about 25 percent of the map unit.

The available water capacity of this Otwell soil is moderate. Permeability is slow above the fragipan and very slow in the fragipan. Runoff is medium, and natural fertility is low or medium. In unlimed areas the soil is moderately acid to very strongly acid. The seasonal high water table is about 2 to 3 1/2 feet below the surface, and this and the fragipan restrict the root zone of deep-rooted plants. Depth to bedrock is more than 60 inches.

In most areas this soil is used for cultivated crops, mainly corn. A small acreage is wooded. The soil is suited to hay and pasture. In unvegetated areas erosion is a moderate hazard. Conservation tillage, contour cultivation, a crop rotation that includes hay, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing in spring until the soil is reasonably firm.

Potential productivity for trees on this soil is moderate. There are few limitations to woodland management.

Seedlings survive and grow well if competing vegetation is controlled. In areas reverting to woodland the dominant tree species is Virginia pine.

The main limitations of this soil for most urban uses are the seasonal high water table, low soil strength, very slow permeability, and potential frost action.

The seasonal high water table is a limitation to use of this soil as sites for dwellings. Installing foundation drains and sealing foundations help to prevent wet basements caused by the seasonal high water table. Erosion is a hazard in areas cleared for construction. Revegetating during or soon after construction helps to control erosion.

The seasonal high water table and very slow permeability in the subsoil are limitations to use of this soil as sites for septic tank absorption fields. Special designs, such as extending the length of the absorption field and digging wide, deep trenches below the distribution lines, help to overcome these limitations. Choosing a site in the included areas of Gallia and Duncannon soils, which have few limitations to this use, is a suitable alternative.

The seasonal high water table, low soil strength, and potential frost action are limitations to use of this soil for local roads and streets. The soil is soft when wet; consequently, pavements crack under heavy traffic. Constructing roads and streets on coarse grained base material helps prevent damage to the pavement caused by low soil strength and frost action. Installing subsurface drainage helps prevent damage to roads and streets caused by the seasonal high water table.

The main limitations of the included soils for most urban uses are low soil strength, shrinking and swelling, and slow permeability in the subsoil on Licking and Woodfield soils. Also on Licking soils, another limitation to most urban uses is the seasonal high water table. Gallia and Duncannon soils have few limitations for dwellings.

The major soil is in capability subclass IIe.

OtC—Otwell silt loam, 8 to 15 percent slopes. This is a very deep, moderately well drained soil on stream terraces along major streams.

Typically, the surface layer is brown silt loam 9 inches thick. The subsoil is 51 inches thick. In the upper 18 inches it is yellowish brown silt loam, and in the next 25 inches it is yellowish brown silt loam mottled with light brownish gray. In the lower 8 inches it is yellowish brown silty clay loam mottled with strong brown. Between depths of 27 and 60 inches it is a firm and brittle layer called a fragipan.

Included with this soil in mapping are small areas of well drained Duncannon, Gallia, and Woodfield soils. Also included are small areas of somewhat poorly drained soils and small areas of soils that have slope of less than 8 percent or more than 15 percent. The included soils make up about 30 percent of the map unit.

The available water capacity of this Otwell soil is moderate. Permeability is slow above the fragipan and very slow in the fragipan. Runoff is rapid, and natural fertility is low or medium. In unlimed areas the soil is moderately acid to very strongly acid. The seasonal high water table is about 2 to 3 1/2 feet below the surface, and this and the fragipan restrict the root zone of deep-rooted plants. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for hay or pasture. A small acreage is wooded. The soil is suited to cultivated crops. In unvegetated areas erosion is a severe hazard. Conservation tillage, crops grown in contour strips, a crop sequence that includes hay, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing in spring until the soil is reasonably firm.

Potential productivity for trees on this soil is moderate. Erosion is a hazard on logging roads and skid trails. Laying out roads and trails close to the contour helps to control erosion. During wet seasons the soil is soft; consequently, the use of heavy equipment is restricted to periods when the soil is dry. Seedlings survive and grow well if competing vegetation is controlled. In areas reverting to woodland, the dominant tree species is Virginia pine.

The main limitations of this soil for most urban uses are slope, the seasonal high water table, low soil strength, and potential frost action.

Slope and the seasonal high water table are limitations to use of this soil as sites for dwellings. Land shaping and grading help to overcome the slope limitation. Installing foundation drains and sealing foundations help to prevent wet basements caused by the seasonal high water table. Erosion is a hazard in areas cleared for construction. Designing dwellings to conform to the natural slope and setting helps to minimize land shaping and to control erosion. Revegetating during or soon after construction also helps to control erosion.

Slope, the seasonal high water table, and very slow permeability in the subsoil are limitations to use of this soil as sites for septic tank absorption fields. Special designs, such as extending the length of the absorption field and digging wide, deep trenches below the distribution lines, help to overcome the limitations of the seasonal high water table and permeability. Land shaping and laying out the lines of the disposal field on the contour or across the slope help to overcome the slope limitation. Gallia and Duncannon soils have few limitations to use as sites for septic tank absorption fields.

Slope, the seasonal high water table, low soil strength, and potential frost action are limitations to use of this soil for local roads and streets. The soil is soft when wet; consequently, pavement cracks under heavy traffic.

Constructing roads and streets on coarse grained base material helps prevent damage to the pavement caused by low soil strength and frost action. Laying out roads and streets close to the contour helps overcome the slope limitation. Installing subsurface drainage helps prevent damage to roads and streets caused by the seasonal high water table.

The main limitations of the included soils for most urban uses are low soil strength, shrinking and swelling, and slow permeability of the subsoil on Licking and Woodsfield soils. Also on Licking soils, another limitation to most urban uses is the seasonal high water table. Gallia and Duncannon soils have few limitations for dwellings with basements.

The major soil is in capability subclass IIIe.

Sn—Sensabaugh silt loam. This is a very deep, well drained soil on flood plains and alluvial fans along small streams. The soil is subject to occasional flooding. Slope ranges from 0 to 3 percent.

Typically, the surface layer is dark reddish brown silt loam about 8 inches thick. The subsoil is dark reddish brown and about 25 inches thick. In the upper 10 inches it is silt loam, and in the lower 15 inches it is very gravelly silt loam. The substratum extends to a depth of 60 inches or more. In the upper 8 inches it is dark reddish brown, very gravelly clay loam, and in the lower 19 inches it is reddish brown, gravelly clay loam.

Included with this soil in mapping are small areas of well drained Chagrin, Hackers, Moshannon, and Vandalia soils, moderately well drained Lindsides soils, and poorly drained Melvin soils. Also included are small areas of soils that are less than 60 inches deep to bedrock and small areas of soils that are on alluvial fans at the mouth of hollows, that have slope of 3 to 8 percent, and that are subject to rare flooding. Also included are a few areas of soils that are subject to frequent flooding. The included soils make up about 25 percent of the map unit.

The available water capacity of this Sensabaugh soil is moderate. Permeability is moderate in the upper part of the subsoil and moderately rapid in the lower part. Runoff is slow, and natural fertility is high. In unlimed areas the soil is moderately acid to neutral. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for hay and pasture. Some areas are used for cultivated crops. A small acreage is wooded. Flooding occurs mainly in late winter and early spring, but in some areas localized flooding damages crops throughout the growing season. Cultivated crops can be grown continuously on this soil, but a cover crop is needed to help to control erosion. Working the residue from the cover crop into the soil helps to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing in spring until the soil is reasonably firm.

Potential productivity for trees on this soil is moderately high. During wet seasons the soil is soft; consequently, the use of heavy equipment is restricted to periods when the soil is dry.

The main limitation of this soil for urban uses is flooding.

Flooding is a limitation to use of this soil as sites for dwellings and septic tank absorption fields.

Flooding is a limitation to use of this soil for local roads and streets. Constructing roads and streets on raised fill over coarse grained base material helps prevent damage to the pavement by flooding.

The main limitations of the included soils for most urban uses are rare flooding on Hackers soils, occasional flooding on Chagrin, Lindsides, Melvin, and Moshannon soils, the seasonal high water table of Lindsides and Melvin soils, and shrinking and swelling, the slip hazard, and low soil strength of Vandalia soils.

The major soil is in capability subclass IIw.

Ta—Taggart silt loam. This is a very deep, somewhat poorly drained soil on stream terraces along the Ohio River. Slope ranges from 0 to 3 percent.

Typically, the surface layer is dark brown silt loam about 11 inches thick. The subsoil extends to a depth of 46 inches. In the upper 9 inches it is pale brown silt loam mottled with light brownish gray and yellowish brown. In the next 14 inches it is light brownish gray silty clay loam mottled with yellowish brown and grayish brown. In the lower 12 inches it is grayish brown silty clay loam mottled with yellowish brown. The substratum extends to a depth of 60 inches or more. It is dark gray clay loam mottled with strong brown and light gray.

Included with this soil in mapping are small areas of well drained Lakin and Wheeling soils and moderately well drained Glenford soils. Also included are small areas of soils that have a dense, brittle subsoil and small areas of soils where rock fragments make up more than 20 percent of the volume in the subsoil and the substratum. Also included are small areas of soils that have a slightly acid subsoil and small areas of soils that have slope of 3 to 8 percent. Also included are some areas of soils, near Arvilla and Little in Tyler County, that are similar to this Taggart soil but are more poorly drained and that are characterized by surface bedding. The included soils make up about 25 percent of the map unit.

The available water capacity of this Taggart soil is high. Permeability in the subsoil is slow. Runoff is slow, and natural fertility is medium or high. In unlimed areas the soil is moderately acid to very strongly acid in the surface layer and the subsoil and slightly acid in the substratum. The seasonal high water table is 1 to 3 feet below the surface, and restricts the root zone of some plants. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for hay and pasture. A small acreage is wooded. If artificially drained, the soils

are suited to cultivated crops. Cultivated crops can be grown continuously on this soil, but a cover crop is needed to help to control erosion. Working residue from the cover crop into the soil helps to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, weed and brush control, rotation grazing, and deferred grazing in spring until the soil is reasonably firm.

Potential productivity for trees on this soil is moderately high. Wet seasons cause low soil strength; consequently, the use of heavy equipment is restricted to periods when the soil is dry.

The main limitations of this soil to most urban uses are the seasonal high water table, low soil strength, potential frost action, and slow permeability in the subsoil.

The seasonal high water table is the main limitation to use of this soil as sites for dwellings. Installing foundation drains and sealing foundations help to prevent wet basements caused by the seasonal high water table.

The seasonal high water table and slow permeability in the subsoil are limitations to use of this soil as sites for septic tank absorption fields. Special designs, such as extending the length of the absorption field and digging wide, deep trenches below the distribution lines, help to overcome these limitations.

Low soil strength, potential frost action, and the seasonal high water table are the main limitations to use of this soil for local roads and streets. The soil is soft when wet; consequently, the pavement cracks under heavy traffic. Constructing roads and streets on coarse grained base material helps to prevent the damaged pavement caused by frost action, low soil strength, and the seasonal high water table. Installing subsurface drainage also helps to prevent damage to roads and streets caused by the seasonal high water table.

The main limitation of the included Glenford soils for dwellings and septic tank absorption fields is the seasonal high water table. The main limitation of the included Lakin and Wheeling soils for septic tank absorption fields is the rapid permeability in the substratum. In some areas of Lakin soils, cutbanks are subject to cave in. Wheeling soils have few limitations for dwellings.

The major soil is in capability subclass IIw.

UpC—Upshur silty clay loam, 8 to 15 percent slopes. This is a deep, well drained soil on ridgetops throughout the survey area. In some areas landslips are common. Erosion has removed one-fourth to three-fourths of the original surface layer of the soil.

Typically, the surface layer is dark reddish brown silty clay loam about 3 inches thick. The subsoil is about 43 inches thick. In the upper 37 inches it is reddish brown silty clay. In the lower 6 inches it is dark reddish brown clay. Shale bedrock is at a depth of 46 inches.

Included with this soil in mapping are small areas of Duncannon, Gilpin, and Woodsfield soils. Also included are soils that are similar to this Upshur soil but are less than 40 inches deep to bedrock, moderately well drained, or extremely acid in the subsoil. Also included are small areas of soils that have slope of less than 8 percent or slope of 15 to 25 percent and small areas of soils where erosion has removed much of the surface layer and where the subsoil is exposed in places. The included soils make up about 25 percent of this map unit.

The available water capacity of this Upshur soil is moderate or high. Permeability in the subsoil is slow. Runoff is rapid, and natural fertility is medium or high. In unlimed areas the soil is very strongly acid to slightly acid. Depth to bedrock ranges from 40 to 60 inches. Shrink-swell potential in the subsoil is high. The soil is subject to slipping.

Most areas of this soil are used for hay and pasture. A small acreage is wooded. In some areas the soil is suited to cultivated crops. In unvegetated areas erosion is a severe hazard. Conservation tillage, crops grown in contour strips, a crop rotation that includes hay crops, shallow drainageways maintained in sod, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing in spring until the soil is reasonably firm.

Potential productivity for trees on this soil is moderate. Erosion is a hazard on logging roads and skid trails. During wet seasons poor traction and low soil strength restrict the use of equipment. Laying out roads and trails close to the contour helps to control erosion.

The main limitations of this Upshur soil for most urban uses are shrinking and swelling, low soil strength, slow permeability, and slope.

Shrinking and swelling is the main limitation to use of this soil as sites for dwellings. Using wide, reinforced footers and installing properly designed surface and subsurface drainage to remove water from footers and foundations help to prevent shrinking and swelling. Erosion is a hazard in areas cleared for construction. Revegetating during or soon after construction helps to control erosion.

Slow permeability is the main limitation to use of this Upshur soil as sites for septic tank absorption fields. Planning larger lots with more suitable soils or using an alternate system helps to overcome this limitation.

Slope, shrinking and swelling, and low soil strength are the main limitations to use of this soil for local roads and streets. Laying out roads and streets close to the contour helps to overcome the slope limitation. Constructing roads and streets on coarse-grained base material and installing collector ditches with cross

culverts to remove surface water help to prevent shrinking and swelling and to overcome low soil strength.

The main limitation of the included soils for most urban uses is slope. Other limitations are depth to bedrock on Gilpin soils and shrinking and swelling and low soil strength of Woodsfield soils. Duncannon soils have few limitations to use as sites for dwellings with basements.

The major soil is in capability subclass IVe.

VaD—Vandalia silt loam, 15 to 25 percent slopes.

This is a very deep, well drained soil on foot slopes and around the heads of drainageways at the base of steep areas of Gilpin and Upshur soils. The soil is throughout the survey area. In some areas it is dissected by drainageways. In some areas landslips (fig. 8) and water seeps are common. Erosion has removed one-fourth to three-fourths of the original surface layer of the soil.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil extends to a depth of about 45 inches. In the upper 19 inches it is reddish brown silty clay loam, and in the lower 20 inches it is reddish brown channery silty clay loam. The substratum is reddish brown channery silty clay loam to a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of well drained Gilpin, Sensabaugh, and Upshur soils. Also included are areas of soils that are similar to the Vandalia soil but have less clay in the subsoil and areas of soils that are less than 60 inches deep over bedrock. Also included are small areas of soils that have slope of less than 15 percent or more than 25 percent and areas of soils where stones cover as much as 15 percent of the surface. Also included are areas of soils



Figure 8.—A landslide in an area of Vandalia silt loam, 15 to 25 percent slopes.

where erosion has removed much of the surface layer and exposed the subsoil in places. The included soils make up about 30 percent of the map unit.

The available water capacity of this Vandalia soil is high. Permeability in the subsoil is slow. Runoff is rapid, and natural fertility is medium or high. In unlimed areas the soil is strongly acid or moderately acid in the upper part of the solum and moderately acid to neutral in the lower part of the solum and in the substratum. Depth to bedrock is more than 60 inches. Shrink-swell potential in the subsoil is high, and the soil is subject to slipping.

About one-half of the acreage of this soil is used for hay and pasture. The rest is woodland. In unvegetated areas erosion is a severe hazard. In cultivated areas, conservation tillage, crops grown in contour strips, a crop rotation that includes hay, shallow drainageways maintained in sod, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing until the soil is reasonably firm.

Potential productivity for trees on this soil is moderately high. Erosion is a hazard on logging roads and skid trails. Laying out roads and trails close to the contour helps to control erosion. Wet seasons cause poor traction and low soil strength; consequently, the use of heavy equipment is restricted to periods when the soil is dry. Some common trees to plant for commercial wood production are black walnut, yellow-poplar, Virginia pine, and eastern white pine.

The main limitations of this Vandalia soil for most urban uses are slope, shrinking and swelling, slow permeability, low soil strength, and landslipping. The soil is better suited to use as pasture, hay, or woodland.

Slope, shrinking and swelling, and landslipping are limitations to use of this soil as sites for dwellings, septic tank absorption fields, and local roads and streets. Water seeps and landslips are common, and disturbing the soil increases the hazard of slipping.

The limitations of the included soils for most urban uses are slope and depth to bedrock on Gilpin soils, occasional flooding on Sensabaugh soils, and slope, slow permeability, low soil strength, shrinking and swelling, and landslipping on Upshur soils.

The major soil is in capability subclass IVe.

VbD—Vandalia silt loam, 15 to 25 percent slopes, very stony. This is a very deep, well drained soil on foot slopes and around the heads of drainageways at the base of steep areas of Gilpin and Upshur soils. The soil is throughout the survey area. Stones commonly 1 foot to 2 feet in diameter cover 3 to 15 percent of the surface. In some areas wet spots and landslips are common. Erosion has removed one-fourth to three-fourths of the original surface layer of the soil.

Typically, the surface layer is dark reddish brown silt loam about 6 inches thick. The subsoil extends to a depth of about 45 inches. In the upper 19 inches it is reddish brown silty clay loam, and in the lower 20 inches it is reddish brown channery silty clay loam. The substratum is reddish brown channery silty clay loam to a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of well drained Gilpin, Sensabaugh, and Upshur soils. Also included are soils that are similar to the Vandalia soil but that have less clay in the subsoil and areas of soils that are less than 60 inches deep to bedrock. Also included are small areas of soils where slope is less than 15 percent or more than 25 percent and areas of soils where stones cover more than 15 percent of the surface. Also included are areas of soils where erosion has removed much of the surface layer and exposed the subsoil in places. The included soils make up about 30 percent of the map unit.

The available water capacity of this Vandalia soil is high. Permeability in the subsoil is slow. Runoff is rapid, and natural fertility is medium or high. In unlimed areas the soil is strongly acid or moderately acid in the surface layer and in the upper part of the subsoil and moderately acid to neutral in the lower part of the subsoil and in the substratum. Depth to bedrock is more than 60 inches. Shrink-swell potential is high, and the soil is subject to slipping.

This soil generally is not suitable for cultivated crops, hay, and pasture because of stones on the surface. About three-fourths of the acreage of the soil is used as woodland, and about one-fourth is used for pasture. The soil is suited to pasture if the surface is cleared of stones. Potential productivity for trees on this soil is moderately high. The main woodland management concerns are the erosion hazard and the equipment limitation because of slope. Wet seasons cause poor traction and low soil strength; consequently, timber harvesting is restricted to periods when the soil is dry. In addition, laying out logging roads close to the contour helps to control erosion. Some common trees to plant for commercial wood production are black walnut, yellow-poplar, Virginia pine, and eastern white pine.

The main limitations to use of this soil as sites for dwellings, septic tank absorption fields, and local roads and streets are slope, low soil strength, shrinking and swelling, landslipping, slow permeability, and surface stones. Water seeps and landslips are common, and disturbing the soil increases the hazard of slipping. The soil is better suited to use as woodland or as habitat for wildlife.

The limitations of the included soils for most urban uses are slope and depth to bedrock on Gilpin soils, occasional flooding on Sensabaugh soils, and slope, slow permeability, low soil strength, shrinking and swelling, and landslipping on Upshur soils.

The major soil is in capability subclass VIIs.

WhA—Wheeling silt loam, 0 to 3 percent slopes.

This is a very deep, well drained soil on stream terraces along the Ohio River.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil extends to a depth of about 52 inches. In the upper 23 inches it is dark yellowish brown silt loam, and in the lower 19 inches it is yellowish brown silt loam. The substratum is yellowish brown loam to a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of excessively drained Lakin soils, well drained Ashton soils, moderately well drained Glenford soils, and somewhat poorly drained Taggart soils. Also included are a few small areas of soils that have a very gravelly subsoil or that have slope of 8 to 15 percent. The included soils make up about 25 percent of the map unit.

The available water capacity of this Wheeling soil is high. Permeability in the subsoil is moderate. Runoff is slow, and natural fertility is high. In unlimed areas the

soil is moderately acid. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for cultivated crops, mainly corn. Some areas are used for hay (fig. 9) and pasture. A small acreage is wooded. Cultivated crops can be grown continuously on this soil, but a cover crop is needed to help to control erosion. Working the residue from the cover crop into the soil helps to maintain soil fertility and soil tilth. The main pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing until the soil is reasonably firm.

Potential productivity for trees on this soil is moderately high. There are few limitations to woodland management. Seedlings survive and grow well if competing vegetation is controlled.

The main limitations of this soil for most urban uses are low soil strength and moderate permeability in the subsoil.



Figure 9.—Hay in an area of Wheeling silt loam, 0 to 3 percent slopes.

There are few limitations to use of this soil as sites for dwellings.

Moderate permeability in the subsoil is the main limitation to use of this soil as sites for septic tank absorption fields. Special designs, such as increasing the size of the absorption field, in some areas help to overcome this limitation.

Low soil strength is the main limitation to use of this soil as sites for local roads and streets. Constructing roads and streets on coarse grained base material helps prevent damage to the pavement caused by low soil strength.

The limitations of the included soils for most urban uses are rare flooding on Ashton soils, the seasonal high water table and low soil strength of Glenford and Taggart soils, and rapid permeability in the substratum of Lakin soils. Also on Lakin soils, cutbanks are subject to cave in.

The major soil is in capability class I.

WhB—Wheeling silt loam, 3 to 8 percent slopes.

This is a very deep, well drained, soil on stream terraces along the Ohio River.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil extends to a depth of about 52 inches. In the upper 23 inches it is dark yellowish brown silt loam, and in the lower 19 inches it is yellowish brown silt loam. The substratum is yellowish brown loam to a depth of 60 inches or more.

Included with this soil in mapping are a few small areas of excessively drained Lakin soils, well drained Ashton soils, moderately well drained Glenford soils, and somewhat poorly drained Taggart soils. Also included are a few small areas of soils that have a subsoil of very gravelly silt loam and areas of soils that have slope of less than 3 percent or slope of 8 to 15 percent. Also included are areas of soils that are similar to the Wheeling soil but that are on short steep slopes adjacent to drainageways. The included soils make up about 35 percent of the map unit.

The available water capacity of this Wheeling soil is high. Permeability in the subsoil is moderate. Runoff is medium, and natural fertility is high. In unlimed areas the soil is moderately acid. Depth to bedrock is more than 60 inches.

Most areas of this soil are used for cultivated crops, mainly corn. Some areas are used for hay and pasture. A small acreage is wooded. In unvegetated areas erosion is a moderate hazard. Conservation tillage, contour cultivation, crop rotation that includes hay, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. The major pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing until the soil is reasonably firm. On short, steep slopes, erosion is a hazard and the use of equipment is limited. In these areas cultivating on

the contour and restricting equipment usage are suitable management practices.

Potential productivity for trees on this soil is moderately high. There are few limitations to woodland management. Seedlings survive and grow well if competing vegetation is controlled.

The main limitations of this soil for most urban uses are low soil strength and moderate permeability in the subsoils.

There are few limitations to use of this soil as sites for dwellings.

Moderate permeability in the subsoil is the main limitation to use of this soil as sites for septic tank absorption fields. Special designs, such as increasing the size of the absorption field, in some areas help to overcome this limitation.

Low soil strength is the main limitation to use of this soil as sites for local roads and streets. Constructing roads and streets on coarse grained base material helps to prevent the damaged pavement caused by low soil strength.

The limitations of the included soils for most urban uses are rare flooding on Ashton soils, the seasonal high water table and low soil strength of Glenford and Taggart soils, and rapid permeability in the substratum of Lakin soils. Also on Lakin soils, cutbanks are subject to cave in.

The major soil is in capability class IIe.

WnB—Wheeling-Urban land complex, 0 to 8 percent slopes. This map unit consists of very deep, well drained Wheeling soil and Urban land. It is about 35 percent Wheeling soil, 25 percent Urban land, and 40 percent other soils, some of which are in industrial use. This soil and Urban land are on stream terraces in urban and industrial areas along the Ohio River. The soil and Urban land are in such an intricate pattern on the landscape that it was not practical to separate them at the scale selected for mapping.

Typically, the surface layer of the Wheeling soil is dark brown silt loam about 10 inches thick. The subsoil extends to a depth of about 52 inches. In the upper 23 inches it is dark yellowish brown silt loam, and in the lower 19 inches it is yellowish brown silt loam. The substratum is yellowish brown loam to a depth of 60 inches or more.

Urban land consists of areas that have been covered by buildings, streets, parking lots, and other urban structures.

Included with this unit in mapping are small areas of somewhat poorly drained Taggart soils and moderately well drained Glenford soils. Also included are small areas of soils that have a very gravelly subsoil or slope of 8 to 15 percent. Also included are industrial dump sites and associated water impoundments, such as extensively disturbed areas as quarries, and sand and gravel storage sites. Also included are areas of soils

used as sites for an electric power plant and such associated facilities as electric substations, cooling towers, coal storage, and fly ash disposal sites. The included soils make up about 40 percent of the map unit.

The available water capacity of this Wheeling soil is high. Runoff is medium. Permeability in the subsoil is moderate. In unlimed areas the soil is moderately acid. Depth to bedrock is more than 60 inches.

This Wheeling soil is not suited to cultivated crops, hay, or pasture or to use as woodland. Most areas are in urban use, such as sites for industry, waste- and water-holding facilities, urban structures (fig. 10), and transportation facilities.

The main limitations of this Wheeling soil for urban uses are low strength and moderate permeability in the subsoil. If the soil is used as sites for septic tank absorption fields, special designs, such as increasing the size of the absorption field, in some areas help to offset the moderate permeability. Providing coarse grained,

subgrade base material helps prevent damage to local roads and streets caused by low soil strength.

The limitations of the included Taggart and Glenford soils for most urban uses are the seasonal high water table and low soil strength.

The Wheeling soil in this map unit has not been assigned to a capability class.

WoC—Woodsfield silt loam, 3 to 15 percent slopes. This is a deep or very deep, well drained soil mainly on summits and ridgetops along the Ohio River and Middle Island Creek. Erosion has removed one-fourth to three-fourths of the original surface layer of the soil.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil extends to a depth of about 50 inches. In the upper 7 inches it is yellowish brown silt loam, in the next 6 inches it is dark yellowish brown silty clay loam, and in the lower 30 inches it is yellowish red silty clay loam, silty clay, and clay. The



Figure 10.—A residential area on Wheeling-Urban land complex, 0 to 8 percent slopes.

substratum is reddish brown silty clay to a depth of 60 inches or more.

Included with this soil in mapping are small areas of well drained Duncannon, Gallia, Gilpin, and Upshur soils and moderately well drained Licking and Otwell soils. Also included are areas of soils that have slope of less than 3 percent or slope of 15 to 25 percent. The included soils make up about 30 percent of the map unit.

The available water capacity of this Woodsfield soil is high. Permeability is moderate in the upper part of the subsoil and slow in the lower part. Natural fertility is medium or high. Runoff is rapid. In unlimed areas the soil is very strongly acid or strongly acid in the surface layer and the upper part of the subsoil, strongly acid to neutral in the lower part of the subsoil, and moderately acid to mildly alkaline in the substratum. Shrink-swell potential in the subsoil is high. Depth to bedrock is 40 to 72 inches.

In most areas this soil is wooded. It is also suited to cultivated crops, hay, and pasture. In unvegetated areas erosion is a severe hazard. Conservation tillage, contour cultivation, and crop residue returned to the soil help to control erosion and to maintain soil fertility and soil tilth. The main pasture management needs are proper stocking rates to maintain desirable grasses and legumes, rotation grazing, and deferred grazing in spring until the soil is reasonably firm.

Potential productivity for trees on this soil is moderately high. Some yellow-poplar trees are on this soil, but the dominant tree species is Virginia pine. There are few limitations to woodland management. Erosion is a hazard. The soil is soft when wet; consequently, the use of heavy equipment is restricted to periods when the soil is dry. Erosion is a hazard on logging roads and skid

trails. Laying out roads and trails close to the contour helps to control erosion. Some common trees to plant for commercial wood production are yellow-poplar and Virginia pine.

The main limitations of this soil for most urban uses are slow permeability in the subsoil, shrinking and swelling, and low soil strength.

Shrinking and swelling is the main limitation to use of this soil as sites for dwellings. The subsoil expands when wet and contracts when dried; consequently, foundations can be damaged. Using reinforced footers and foundations and backfilling with a sandy material help to prevent shrinking and swelling.

Slow permeability is the main limitation to use of this soil as sites for septic tank absorption fields. Increasing the length of the absorption field or designing an alternate system helps to overcome this limitation. In some areas selecting a better suited soil is a suitable alternative.

Low soil strength and shrinking and swelling are the main limitations to use of this soil for local roads and streets. Constructing roads and streets on coarse grained base material helps to overcome these limitations.

The main limitation of the included soils and steeper areas of the Woodsfield soil for most urban uses is slope. Other limitations are depth to bedrock in Gilpin soils, low soil strength of Gallia and Upshur soils, shrinking and swelling and the slip hazard on Upshur soils, and the seasonal high water table of Otwell and Lakin soils. Gallia and Duncannon soils have few limitations to use as sites for dwellings.

The major soil is in capability subclass IIIe.

Prime Farmland

Prime farmland is one of several kinds of important farmlands defined by the U.S. Department of Agriculture. Identification of prime farmland is a major step in meeting the Nation's needs for food and fiber.

The U.S. Department of Agriculture defines prime farmland as the land that is best suited to producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, growing season, and moisture supply needed to produce a sustained high yield of crops while using acceptable farming methods. Prime farmland produces the highest yields and requires minimal amounts of energy and economic resources, and farming it results in the least damage to the environment.

An area identified as prime farmland must be used for producing food or fiber or must be available for those uses. Thus, urban and built-up land and water areas are not classified as prime farmland.

The general criteria for prime farmland are as follows: a generally adequate and dependable supply of moisture from precipitation or irrigation, favorable temperature and growing-season length, acceptable levels of acidity or

alkalinity, few or no rocks, and permeability to air and water. Prime farmland is not excessively erodible, is not saturated with water for long periods, and is not flooded during the growing season. The slope range is mainly from 0 to 8 percent. For more detailed information on the criteria for prime farmland, consult the local staff of the Soil Conservation Service.

The survey area contains about 16,310 acres of prime farmland. That acreage makes up about 6.5 percent of the total acreage in the survey area and is mainly on the islands, terraces, and flood plain of the Ohio River.

The soil map units that make up prime farmland in the survey area are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4, and the location of each unit is shown on the detailed soil maps at the back of this publication. The soil properties and characteristics that affect use and management of the units are described in the section "Detailed Soil Map Units."

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Dixie L. Shreve, resource conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated

yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

Some general principles of management apply throughout the survey area to all soils suitable for farm crops and pasture, but individual soils or groups of soils require different kinds of management.

On most soils in the survey area, the supply of plant nutrients is moderate or low and applications of lime and fertilizer are necessary. The amounts to be applied depend on the type of soil, cropping history, type of crop grown, the level of desired yield, and tests and analyses of the soil.

The organic matter content in most cultivated soils is low, and increasing it is not feasible. It can be maintained by adding farm manure, returning crop residue to the soil, and growing sod crops, cover crops, and green manure crops.

Tillage tends to break down soil structure, and should be kept to the minimum necessary to prepare the seedbed and to control weeds. The use of chemical weed control instead of tillage and maintaining the organic matter content of the plow layer help to maintain soil structure.

Artificial drainage is needed on Glenford, Lindside, Melvin, and Taggart soils for cultivated crops, hay, and pasture. Otwell and Licking soils are difficult to drain with tile. Otwell soils have a dense, brittle layer, and Licking soils have a clayey subsoil. Such soils generally are more suitable to open ditch drainage.

Runoff and erosion occur mainly while a cultivated crop is growing or soon after it has been harvested. On all of the gently sloping and steeper soils under cultivation, erosion is a hazard. Consequently, on these soils a suitable cropping system is needed to control erosion. The main management needs in such a system include proper crop rotation, conservation tillage, mulch planting, using crop residue, growing cover crops and green manure crops, and using lime and fertilizer. Contour cultivation, contour strip cropping, and grassed waterways also help to control erosion. A combination of these practices differs in effectiveness from one soil to

another, but different combinations can be equally effective on the same soil.

In most areas using the soils for pasture is effective in controlling erosion. On some soils pasture management that includes fertilization, controlled grazing, and careful selection of pasture mixtures is needed to provide enough ground cover to control erosion. Grazing is controlled by rotating livestock and deferring grazing to allow regrowth of pasture plants. On some soils pasture mixtures that require the least renovation help to maintain good ground cover and good forage for grazing.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally

expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey. The levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar

management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Charles L. Rowan, forester, Soil Conservation Service, helped prepare this section.

Woodland in Pleasants and Tyler Counties covers about 187,700 acres, or nearly 77 percent of the total land area. The tracts range in size from small farm woodlots to large, corporate woodland.

About half of the forested areas are old fields that have reverted to woody species that have grown to pole and sawtimber size.

The common forest types, or natural associations of tree species, and their percentage of the woodland are oak-hickory, 65 percent; maple-beech, 14 percent; other hardwoods, 15 percent; and pine, 6 percent (3).

The aspects of some soils, generally those that have slope of more than 15 percent, are shown in table 8. North aspects face in any compass direction from 315 to 135 degrees. South aspects face in any compass direction from 135 to 315 degrees. Aspect affects potential productivity of sloping soils. The soils on north aspects generally are moister, and generally have a higher site index than the same soils on south aspects. Aspect also affects the occurrence of tree species and the degree of management concerns.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed in the tables. The table gives the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, that the indicator species can produce. The larger the number, the greater the potential productivity. The number 1 indicates low productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 through 8, high; 9 through 11, very high; and 12 or more, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation for use and management. The letter *R* indicates steep slopes; *X*, stones or rocks on the surface; *W*, excessive water in or on the soil; *T*, excessive alkalinity, acidity, sodium salts, or other toxic substances in the soil; *D*, restricted rooting depth caused by bedrock, hardpan, or other restrictive layer; *C*, clay in the upper part of the soil; *S*, sandy

texture; and *F*, high content of rock fragments in the soil profile. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: *R*, *X*, *W*, *T*, *D*, *C*, *S*, and *F*.

In table 8, *slight*, *moderate*, and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that erosion can occur as a result of site preparation or following cutting operations and where the soil is exposed, for example, roads, skid trails, fire lanes, and log handling areas. Forests that are abused by fire or overgrazing are also subject to erosion. The ratings for the erosion hazard are based on the percent of the slope and on the erosion factor *K* shown in table 16. A rating of *slight* indicates that no particular measures to prevent erosion are needed under ordinary conditions. A rating of *moderate* indicates that erosion control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

The proper construction and maintenance of roads, trails, landings, and fire lanes will help overcome the erosion hazard.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that equipment use normally is not restricted either in kind of equipment that can be used or time of year because of soil factors. If soil wetness is a factor, equipment use can be restricted for a period not to exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If soil wetness is a factor, equipment use is restricted for 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either in kind of equipment or season of use. If soil wetness is a factor, equipment use is restricted for more than 3 months.

Choosing the most suitable equipment and timing harvesting and other management operations to avoid seasonal limitations help overcome the equipment limitation.

Seedling mortality refers to the probability of death of naturally occurring or planted tree seedlings as influenced by kinds of soil or topographic conditions. The factors considered in rating the soils for seedling mortality are texture of the surface layer, depth and duration of the water table, rock fragments in the surface layer, rooting depth, and aspect of the slope. A rating of *slight* indicates that under usual conditions the expected mortality is less than 25 percent. A rating of *moderate* indicates that the expected mortality is 25 to 50 percent.

Extra precautions are advisable. A rating of *severe* indicates that the expected mortality is more than 50 percent. Extra precautions are important. Replanting may be necessary.

The use of special planting stock and special site preparation, such as bedding, furrowing, or surface drainage, can help reduce seedling mortality.

Plant competition is the likelihood of the invasion or growth of undesirable species where openings are made in the canopy. The main factors that affect plant competition are depth to the water table and available water capacity of the soil. A rating of *slight* indicates that competition from unwanted plants is not likely to suppress the more desirable species or prevent their natural regeneration. Planted seedlings have good prospects for development without undue competition. A rating of *moderate* indicates that competition may delay the natural regeneration of desirable species or of planted trees and may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent natural regeneration or restrict planted seedlings unless precautionary measures are taken.

Adequate site preparation before planting the new crop can help reduce plant competition.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as *site index* and *average annual growth*. Site index is the average height, in feet, that dominant and codominant trees of a given species attain in 50 years. The site index applies to fully stocked, even-aged, unmanaged stands. Common trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability. Average annual growth, per acre, of some of the common trees is expressed as cubic feet per acre, board feet per acre, and cords per acre (5).

Recreation

Paul D. Meadows, Superintendent of Parks and Recreation, Pleasants County Parks and Recreation Commission, helped prepare this section.

Persons who plan, develop, and maintain recreation areas need soils information. The survey area takes in several outdoor recreation areas. Most of the recreation facilities, such as golf courses and parks, are near major urban centers adjacent to the Ohio River.

The major recreation areas in Pleasants County are Pleasants County Park, in St. Marys, and Belmont Recreation Area, 3 miles south of St. Marys. The areas have paths and trails for hiking, playgrounds, and picnic areas and provide opportunities for swimming, baseball, and basketball.

In Tyler County, Conaway Lake and the Jug Public Hunting and Fishing Area are operated by the West

Virginia Department of Natural Resources. They offer camping facilities as well as provide opportunities for hiking, hunting, and fishing.

Other types of recreation are available. Boating and fishing are popular on the approximately 6,630 acres of water in the survey area. Boat launching and fishing access sites are on the Ohio River and Middle Island Creek.

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or

stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Gary A. Gwinn, biologist, Soil Conservation Service, helped prepare this section.

Wildlife populations in the counties are abundant and varied. Game species that are common in the counties include white-tailed deer, wild turkey, cottontail, ruffed grouse, mourning dove, gray squirrels, fox squirrels, and woodcock. The counties are adjacent to the Ohio River, and support large waterfowl populations.

Nongame species in the counties include a variety of raptors and wood warblers and other songbirds. Several species of reptiles and amphibians also inhabit the counties.

The kinds and quantities of wildlife that inhabit a given area are determined by land use and vegetative type. More than 75 percent of the counties is deciduous, hardwood forest lands that support woodland wildlife. Openland wildlife, such as meadowlarks and cottontail, are generally restricted to larger stream bottom lands. If openland in the counties continues to revert to forest, such openland species as bobwhite quail are expected to continue to decline in numbers.

As openland wildlife are in decline in the counties, woodland species, such as deer and turkey, are increasing in population and are expected to continue to increase.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate

vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, timothy, brome grass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggar-ticks, quackgrass, and ragweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil

properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, birch, cherry, maple, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are gray dogwood, mountain ash, viburnums, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, yew, red cedar, and hemlock.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness. Examples of wetland plants are smartweed, arrowhead, burreed, pickerelweed, cordgrass, rushes, sedges, and cattails.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, swamps, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite quail, meadow vole, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, frogs, and tree swallow.

Engineering

James L. Dove, conservation engineer, Soil Conservation Service, helped prepare this section.

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are

given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, soil density, shear strength, bearing strength, and consolidation. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, impoundments, and topsoil; (7) plan drainage systems, irrigation systems, ponds, agricultural waste storage structures, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material, a base of gravel, crushed rock, or stabilized soil material, and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high

water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect

public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill: trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth

of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined

by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, or stones, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel or stones, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the

root zone, such as sulfur. Availability of drainage outlets is not considered in the ratings.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A low available water capacity, restricted rooting depth, toxic substances, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (2) and the system adopted by the American Association of State Highway and Transportation Officials (1).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 17 gives the frequency of flooding.

Frequency is estimated. Frequency generally is expressed as *none*, *rare*, *occasional*, *common*, or *frequent*. *None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (there is a near 0 to 5 percent chance of flooding in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (there is a 5 to 50 percent chance of flooding in any year). *Frequent* means that flooding occurs often under normal weather conditions (there is more than a 50 percent chance of flooding in any year).

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in

organic matter content with increasing depth; and absence of distinctive horizons, which are characteristic of soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely, grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table, that is, *perched*, *artesian*, or *apparent*; and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An *artesian* water table is under hydrostatic head, generally below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

The two numbers in the "High water table-Depth" column indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that the water table exists for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is

not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil.

Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (9). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Ultisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udult (*Ud*, meaning humid, plus *ult*, from Ultisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludults (*Hapl*, meaning minimal horizonation, plus *udult*, the suborder of the Ultisols that has an udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludults.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties

and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, mesic Typic Hapludults.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

Dr. John Sencindiver, associate professor of agronomy, West Virginia Agricultural and Forestry Experiment Station, helped prepare this section.

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual* (8). Many of the technical terms used in the descriptions are defined in *Soil Taxonomy* (9). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Ashton Series

The Ashton series consists of very deep, well drained soils that formed in alluvial material washed from soils on uplands. These soils are on high flood plains along the Ohio River. Flood control structures on the Ohio River system have reduced the frequency of flooding on the soils. The soils are subject to rare flooding in late

winter and in early spring, before crops are planted. Slope ranges from 0 to 8 percent.

Ashton soils are near Chagrin, Huntington, Lindside, Melvin, and Wheeling soils. Chagrin and Huntington soils are subject to occasional flooding. Ashton soils are fine-silty, but Chagrin and Wheeling soils are fine-loamy. Lindside soils are moderately well drained, and Melvin soils are poorly drained. Wheeling soils are not subject to flooding.

Typical pedon of Ashton silt loam, 0 to 3 percent slopes, in Pleasants County, between West Virginia Route 2 and the Chessie System railroad, south of the road to Willow Island Dam, in a cornfield:

- Ap—0 to 10 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; many fine roots; moderately acid; clear smooth boundary.
- BA—10 to 17 inches; dark brown (7.5YR 4/4) silt loam; weak medium subangular blocky structure; friable; common fine roots; moderately acid; clear wavy boundary.
- Bt1—17 to 40 inches; dark brown (7.5YR 4/4) silty clay loam; moderate and strong medium subangular blocky structure; friable; few fine roots; common distinct clay films on faces of peds; slightly acid; clear wavy boundary.
- Bt2—40 to 55 inches; dark brown (7.5YR 4/4) silt loam; weak medium and coarse subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; moderately acid; gradual wavy boundary.
- C—55 to 65 inches; dark brown (7.5YR 4/4) silt loam; massive; friable; moderately acid.

The solum ranges from 50 to 60 inches in thickness. Depth to bedrock is more than 60 inches. In some pedons rock fragments make up as much as 5 percent of the volume of individual horizons. The soils are moderately acid to neutral throughout.

The Ap horizon has hue of 10YR, value of 3, and chroma of 2 or 3.

The BA horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 3 to 4.

The Bt horizon has hue of 7.5YR, value of 4, and chroma of 3 or 4. It is silt loam or silty clay loam.

The C horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 3 or 4. It is silt loam, silty clay loam, loam, or fine sandy loam.

Cedarcreek Series

The Cedarcreek series consists of very deep, well drained soils that formed in an acid regolith from the surface mining of coal. The regolith is mixed, partly weathered fine earth, fragments of sandstone, shale, and mudstone, and small amounts of coal. These soils are

on benches, hill slopes, and out slopes near Borland, in Pleasants County. Slope ranges from 15 to 60 percent.

Cedarcreek soils are near Gilpin and Upshur soils. Unlike Gilpin and Upshur soils, they formed in the regolith from surface mining.

Typical pedon of Cedarcreek channery silt loam, steep, stony, in Pleasants County, 1 mile northwest of Borland, in a wooded area:

- A—0 to 8 inches; strong brown (7.5YR 5/6) channery silt loam; moderate medium granular structure; friable; many fine and medium roots; 35 percent channers and stones (60 percent sandstone, 30 percent shale, and 10 percent coal); very strongly acid; clear wavy boundary.
- C1—8 to 21 inches; brownish yellow (10YR 6/6) very channery silt loam; common medium brown and gray lithochromic mottles; massive; firm; few fine roots; 40 percent channers and stones (60 percent mudstone, 25 percent shale, and 15 percent coal fragments); strongly acid; clear wavy boundary.
- C2—21 to 65 inches; brownish yellow (10YR 6/6) very channery silt loam; common medium brown and gray lithochromic mottles; massive; firm; few fine roots; 50 percent channers and stones (55 percent mudstone, 25 percent sandstone, and 20 percent coal fragments); very strongly acid.

Depth to bedrock is more than 60 inches. Unlimed soils range from strongly acid to extremely acid. Rock fragments, mostly less than 10 inches in size, are sandstone, mudstone, shale, and coal. They range, by volume, from 35 to 80 percent. Some pedons have stones and boulders. In most pedons some or all horizons have red, brown, yellow, or gray lithochromic mottles.

The A horizon has hue of 7.5YR to 5Y, value of 2 to 5, and chroma of 1 to 6.

The C horizon has hue of 10YR to 5Y, value of 2 to 6, chroma of 1 to 8. Fine earth material is silt loam, loam, or sandy loam.

Chagrin Series

The Chagrin series consists of very deep, well drained soils that formed in alluvial material that washed from soils on uplands. These soils are on the islands in the Ohio River, on low flood plains along the Ohio River, and along some of the smaller streams in the survey area. Flood control structures have reduced the frequency of flooding on these soils on the islands and along the flood plains of the Ohio River. The soils are subject to occasional flooding in winter and spring, before crops are planted. Slope ranges from 0 to 3 percent.

Chagrin soils are near Ashton, Hackers, Huntington, Lindside, Melvin, Moshannon, and Sensabaugh soils. Lindside soils are moderately well drained, and Melvin

soils are poorly drained. Ashton and Hackers soils are subject to rare flooding. Chagrin soils are fine-loamy. The associated soils except Sensabaugh soils are fine-silty. Unlike Chagrin soils, Sensabaugh soils have a gravelly subsoil and substratum.

Typical pedon of Chagrin loam, in Pleasants County, along Cow Creek about 2,500 feet southeast of the intersection of West Virginia Route 2 and County Road 10, in a hayfield:

- Ap—0 to 11 inches; dark brown (10YR 4/3) loam; moderate medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.
- Bw—11 to 38 inches; brown (7.5YR 4/4) loam; weak, medium and coarse subangular blocky structure; friable; many fine roots; neutral; clear wavy boundary.
- C—38 to 65 inches; brown (7.5YR 4/4) sandy loam; massive; very friable; few fine roots; neutral.

The solum ranges from 32 to 48 inches in thickness. Depth to bedrock is more than 60 inches. In some pedons rock fragments make up as much as 10 percent, by volume, of the A horizon and as much as 15 percent of the B and C horizons. The soils are moderately acid to neutral.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 to 4.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam, fine sandy loam, or silt loam.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is sandy loam or loam.

Duncannon Series

The Duncannon series consists of very deep, well drained soils that formed in wind-blown silt and very fine sand deposits. These soils are on the western side of hills and ridgetops facing the Ohio River. Slope ranges from 8 to 25 percent.

Duncannon soils are near well drained Gallia, Gilpin, Lakin, Licking, Otwell, Upshur, and Woodsfield soils. Duncannon soils are coarse-silty. Gallia and Gilpin soils are fine-loamy, Lakin soils are sandy, and Licking, Upshur, and Woodsfield soils are clayey. Unlike Duncannon soils, Licking and Otwell soils are moderately well drained and Lakin soils are excessively drained. Unlike Duncannon soils, Otwell soils have a fragipan.

Typical pedon of Duncannon silt loam, 8 to 15 percent slopes, in Pleasants County, about 3,200 feet east of the junction of West Virginia Route 2 and County Route 4, in a hayfield:

- Ap—0 to 6 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; many fine and medium roots; moderately acid; abrupt smooth boundary.

BA—6 to 11 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common fine roots; strongly acid; clear smooth boundary.

Bt—11 to 30 inches; strong brown (7.5YR 5/6) silt loam; moderate medium and coarse subangular blocky structure; friable; few fine roots; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—30 to 38 inches; strong brown (7.5YR 5/6) silt loam; weak medium and coarse subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; moderately acid; gradual wavy boundary.

BC—38 to 52 inches; strong brown (7.5YR 5/6) silt loam; weak very coarse prismatic structure; friable; moderately acid; abrupt wavy boundary.

C—52 to 65 inches; yellowish brown (10YR 5/4) fine sandy loam; massive; friable; few fine and medium strong brown (7.5YR 5/8) mottles; strongly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is more than 60 inches. Fragments of shale and sandstone make up, by volume, as much as 10 percent of the BC and C horizons. Unlimed soils are moderately acid or strongly acid in the solum and range from slightly acid to strongly acid in the substratum.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4.

The BA, Bt, and BC horizons have hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or fine sandy loam.

Gallia Series

The Gallia series consists of very deep, well drained soils that formed in alluvial material washed from soils on uplands. These soils are on stream terraces of the Ohio River, Middle Island Creek, and other major streams in the survey area. Slope ranges from 8 to 25 percent.

Gallia soils are near Duncannon, Licking, Otwell, and Woodsfield soils. Gallia soils are fine-loamy. Duncannon soils are coarse-silty, Licking and Woodsfield soils are clayey, and Otwell soils are fine-silty. Unlike Gallia soils, Licking and Otwell soils are moderately well drained. Unlike Gallia soils, Otwell soils have a fragipan.

Typical pedon of Gallia silt loam, 8 to 15 percent slopes, in Pleasants County, about 1/8 mile south of Middle Island Creek, about 1/2 mile east of the Pleasants-Tyler Counties line, in pasture:

- Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam; moderate medium granular structure; friable; many fine roots; slightly acid; clear smooth boundary.

BA—7 to 13 inches; strong brown (7.5YR 4/6) silt loam; weak medium subangular blocky structure; friable; common fine roots; strongly acid; clear wavy boundary.

Bt1—13 to 26 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.

Bt2—26 to 51 inches; reddish brown (5YR 4/4) clay loam; weak very coarse prismatic structure parting to strong brown medium and coarse subangular blocky; firm; plastic; few fine roots; common distinct clay films on faces of peds; few fine and medium black concretions; very strongly acid; clear wavy boundary.

Bt3—51 to 65 inches; strong brown (7.5YR 5/6) clay loam; weak very coarse prismatic structure parting to weak coarse subangular blocky; friable; common distinct clay films on faces of peds; few fine and medium black concretions; very strongly acid.

The solum ranges from 60 to 80 inches in thickness. Depth to bedrock is more than 60 inches. In some pedons rock fragments make up as much as 15 percent of the subsoil and the substratum. Unlimed soils are strongly acid or very strongly acid.

The Ap horizon has hue of 10YR to 7.5YR, value of 4 or 5, and chroma of 3 or 4.

The BA horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6.

The Bt horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. Fine earth material is clay loam or sandy clay loam.

Gilpin Series

The Gilpin series consists of moderately deep, well drained soils that formed in material weathered from shale, siltstone, and sandstone. These soils are on ridgetops, benches, and hillsides throughout the survey area. Slope ranges from 8 to 70 percent.

Gilpin soils are near Cedar creek, Duncannon, Sensabaugh, Upshur, Vandalia, and Woodsfield soils. Unlike Gilpin soils, Cedar creek soils have been disturbed by surface mining. Gilpin soils are fine-loamy, but Duncannon soils are coarse-silty and Upshur, Vandalia, and Woodsfield soils are clayey. Gilpin soils are not subject to flooding, but Sensabaugh soils are subject to occasional flooding.

Typical pedon of Gilpin silt loam, in an area of Gilpin-Upshur complex, 35 to 70 percent slopes, in Pleasants County, on the east side of Bens Run Road, about 1/2 mile north of Arvilla, in woodland:

Oi—1 to 0 inches; hardwood leaf litter.

A—0 to 3 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine and medium granular

structure; very friable; many fine and medium roots; 5 percent shale fragments; very strongly acid; abrupt wavy boundary.

BA—3 to 7 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; common fine and medium roots; 10 percent shale fragments; very strongly acid; clear wavy boundary.

Bt1—7 to 19 inches; yellowish brown (10YR 5/4) channery silt loam; moderate medium subangular blocky structure; friable; common fine roots; common faint clay films on faces of peds; 20 percent shale and siltstone fragments; very strongly acid; clear wavy boundary.

Bt2—19 to 30 inches; brown (7.5YR 5/4) very channery silt loam; weak and moderate medium subangular blocky structure; friable; common fine roots; common faint clay films on faces of peds; 40 percent shale and sandstone fragments; very strongly acid; abrupt wavy boundary.

R—30 inches; olive brown, fine grained sandstone.

The solum ranges from 20 to 36 inches in thickness. Depth to bedrock ranges from 20 to 40 inches. The content of shale, siltstone, and sandstone fragments ranges from 5 to 40 percent in the solum and from 30 to 70 percent in the C horizon. Unlimed soils are strongly acid or very strongly acid.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4.

The BA horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 8. Fine earth material is silt loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 8. Fine earth material is silt loam or silty clay loam.

Glenford Series

The Glenford series consists of very deep, moderately well drained soils that formed in alluvial material and glacial outwash. These soils are on the terraces of the Ohio River. Slope ranges from 0 to 3 percent, but is generally 2 percent or less.

Glenford soils are near Lakin, Taggart, and Wheeling soils. Lakin soils are excessively drained, Taggart soils are somewhat poorly drained, and Wheeling soils are well drained. Glenford soils are fine-silty, but Lakin soils are sandy and Wheeling soils are fine-loamy.

Typical pedon of Glenford silt loam, about 200 feet east of West Virginia Route 2, about 1 3/4 miles north of the junction of West Virginia Route 2 and Middle Island Creek, in pasture:

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam; moderate medium granular structure; friable; common fine roots; moderately acid; clear smooth boundary.

- Bt1—7 to 16 inches; yellowish brown (10YR 5/6) silty clay loam; few fine dark brown (10YR 4/3) mottles; moderate medium subangular blocky structure; friable; few distinct clay films on faces of peds; few fine roots; strongly acid; clear smooth boundary.
- Bt2—16 to 28 inches; yellowish brown (10YR 5/4) silty clay loam; common fine dark yellowish brown (10YR 4/6), brown (7.5YR 5/4), and light brownish gray (10YR 6/2) mottles; moderate medium and coarse subangular blocky structure; friable; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.
- Bt3—28 to 55 inches; dark yellowish brown (10YR 4/4) silt loam; common fine dark yellowish brown (10YR 4/6), brown (7.5YR 5/4), and light brownish gray (10YR 6/2) mottles; moderate medium and coarse subangular blocky structure; friable; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.
- C—55 to 65 inches; yellowish brown (10YR 5/4) silt loam; few medium light brownish gray (10YR 6/2) and brown (10YR 5/3) mottles; weak coarse and very coarse platy structure; friable; moderately acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is more than 60 inches. The soils are strongly acid or moderately acid in the upper part of the solum and range from moderately acid to neutral in the lower part.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay loam or silt loam.

The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 8. It is silt loam, silty clay loam, loam, or fine sandy loam.

Hackers Series

The Hackers series consists of very deep, well drained soils that formed in alluvial material washed from soils on uplands. These soils are on high flood plains mainly along Middle Island Creek and other major streams. They are subject to rare flooding. Slope ranges from 0 to 8 percent.

Hackers soils are near Chagrin, Lindside, Melvin, Moshannon, and Sensabaugh soils. The associated soils are subject to occasional flooding. Unlike Hackers soils, Lindside soils are moderately well drained and Melvin soils are poorly drained. Hackers soils are fine-silty, but Chagrin and Sensabaugh soils are fine-loamy. Unlike Hackers soils, Sensabaugh soils have a gravelly subsoil and substratum.

Typical pedon of Hackers silt loam, 3 to 8 percent slopes, in Tyler County, between Middle Island Creek and West Virginia Route 18 about 1/2 mile southeast of Middlebourne, in a meadow:

- Ap—0 to 8 inches; dark brown (7.5YR 4/4) silt loam; moderate medium granular structure; friable; many very fine and fine roots; strongly acid; abrupt smooth boundary.
- Bt1—8 to 22 inches; reddish brown (5YR 4/4) silty clay loam; moderate medium and coarse subangular blocky structure; friable; few fine roots; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.
- Bt2—22 to 38 inches; reddish brown (5YR 4/4) silty clay loam; strong medium and coarse subangular blocky structure; firm; few fine roots; common distinct clay films on faces of peds; strongly acid; gradual smooth boundary.
- Bt3—38 to 44 inches; yellowish red (5YR 4/5) silt loam; moderate medium and coarse subangular blocky structure; firm; few fine roots; few distinct clay films on faces of peds; strongly acid; gradual smooth boundary.
- C—44 to 65 inches; reddish brown (5YR 4/4) silt loam; common medium light reddish brown (5YR 6/3) mottles; massive; friable; moderately acid.

The solum ranges from 30 to 50 inches in thickness. Depth to bedrock is more than 60 inches. In some pedons rock fragments make up as much as 5 percent of individual horizons. Unlimed soils are strongly acid or moderately acid.

The Ap horizon has hue of 10YR or 7.5YR and value and chroma of 3 or 4.

The Bt horizon has hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 4 to 6. It is silt loam or silty clay loam.

The C horizon has hue of 5YR or 2.5YR and value and chroma of 3 or 4. In some pedons it is stratified. It is silt loam, loam, or fine sandy loam.

Huntington Series

The Huntington series consists of very deep, well drained soils that formed in alluvial material washed from soils on uplands. These soils are on flood plains along the Ohio River. Flood control structures on the Ohio River system have reduced the frequency of flooding on these soils. The soils are subject to occasional flooding in late winter and early spring, before crops are planted. Slope ranges from 0 to 3 percent.

Huntington soils are near Ashton, Chagrin, Lindside, and Melvin soils. Huntington soils are subject to more frequent flooding than Ashton soils. Huntington soils are fine-silty, and Chagrin soils are fine-loamy. Unlike Huntington soils, Lindside soils are moderately well drained and Melvin soils are poorly drained.

Typical pedon of Huntington silt loam, in Tyler County, between the Ohio River and West Virginia Route 2 at a campground about 1 1/2 miles south of Sisterville, in an idle field:

Ap—0 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bw1—14 to 44 inches; dark brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable; many fine roots; neutral; abrupt smooth boundary.

Bw2—44 to 58 inches; dark brown (10YR 4/3) silt loam; weak fine and medium subangular blocky structure; friable; few fine roots; neutral; gradual wavy boundary.

C—58 to 65 inches; dark brown (10YR 4/3) loam; massive; very friable; neutral.

The solum ranges from 50 to 65 inches in thickness. Depth to bedrock is more than 60 inches. In some pedons rock fragments make up as much as 3 percent of individual horizons. The soils are slightly acid or neutral.

The Ap horizon has hue of 10YR, value of 3, and chroma of 2 or 3.

The B horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. In some pedons it is stratified. It is silt loam, loam, or sandy loam.

Lakin Series

The Lakin series consists of very deep, excessively drained soils that formed in eolian or alluvial materials. These soils are on terraces and hillsides adjacent to the Ohio River. Slope ranges from 8 to 15 percent.

Lakin soils are near Duncannon, Glenford, Taggart, and Wheeling soils. Lakin soils are sandy, but Duncannon soils are coarse-silty, Glenford and Taggart soils are fine-silty, and Wheeling soils are fine-loamy. Unlike Lakin soils, Duncannon and Wheeling soils are well drained, Glenford soils are moderately well drained, and Taggart soils are somewhat poorly drained.

Typical pedon of Lakin loamy fine sand, 8 to 15 percent slopes, in Pleasants County, about 150 feet east of West Virginia Route 2, about 1 mile north of the junction of West Virginia Route 2 and Oak Grove Road, in woodland:

Ap1—0 to 3 inches; dark brown (10YR 4/3) loamy fine sand; weak fine granular structure; very friable; many fine and medium roots; moderately acid; clear smooth boundary.

Ap2—3 to 10 inches; dark yellowish brown (10YR 4/4) loamy fine sand; weak medium granular structure; very friable; many fine and medium roots; moderately acid; clear smooth boundary.

E—10 to 21 inches; yellowish brown (10YR 5/6) loamy fine sand; weak granular structure; very friable;

common fine roots; moderately acid, clear smooth boundary.

E and Bt1—21 to 54 inches; yellowish brown (10YR 5/6) loamy fine sand (E); single grained; loose; few 1/8 to 3/4 inch thick lamellae of strong brown (7.5YR 4/6) sandy loam (Bt1); weak medium granular structure; very friable; clay bridging sand grains in lamellae; few fine roots; moderately acid; clear wavy boundary.

E and Bt2—54 to 65 inches; yellowish brown (10YR 5/4) sand (E); single grained; loose; few 1/4 to 3/4 inch thick lamellae of strong brown (7.5YR 4/6) loamy sand (Bt2); weak fine granular structure; very friable; clay bridging sand grains in lamellae; moderately acid; gradual wavy boundary.

The solum ranges from 40 to 80 inches or more in thickness. Depth to bedrock is more than 60 inches. In unlimited areas reaction is strongly acid or moderately acid.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. It is loamy fine sand, loamy sand, or sand.

The E part of the E and Bt horizons (lamellae) has hue of 10YR, value of 5 or 6, and chroma of 4 to 6. It is loamy fine sand, loamy sand, or sand. The Bt (lamellae) part of the E and Bt horizons has hue of 7.5YR or 5YR, value of 4, and chroma of 4 to 6. It is loamy sand or sandy loam. The lamellae in the E and Bt horizons are 1/8 to 3/4 inch thick. The combined total thickness of the lamellae (Bt) in the particle-size control section is less than 6 inches.

Licking Series

The Licking series consists of very deep, moderately well drained soils that formed in alluvium or loess over calcareous, clayey lacustrine deposits. These soils are on terraces along Middle Island Creek. Slope ranges from 8 to 15 percent.

Licking soils are near Duncannon, Gallia, Otwell, and Woodsfield soils. Unlike Licking soils, Duncannon, Gallia, and Woodsfield soils are well drained. Licking soils are clayey, but Duncannon soils are coarse-silty, Gallia soils are fine-loamy, and Otwell soils are fine-silty.

Typical pedon of Licking silt loam, 8 to 15 percent slopes, in Pleasants County, about 100 feet north of County Route 7, about 3/4 mile east of its junction with Arvilla bridge, in a meadow:

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam; moderate fine and medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

- Bt1—8 to 15 inches; dark yellowish brown (10YR 4/6) silty clay loam; common medium yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; common distinct clay films on faces of peds; friable; common fine roots; very strongly acid; clear smooth boundary.
- Bt2—15 to 20 inches; brown (7.5YR 4/4) silty clay loam; common fine and medium light brownish gray (10YR 6/2) and strong brown (7.5YR 5/8) mottles; moderate medium and coarse subangular blocky structure; friable; common distinct clay films on faces of peds; very strongly acid; abrupt smooth boundary.
- Bt3—20 to 41 inches; reddish brown (5YR 4/4) silty clay; common fine, medium, and coarse pinkish gray (7.5YR 6/2), strong brown (7.5YR 5/6), and light gray (7.5YR 7/1) mottles; weak coarse prismatic structure parting to moderate medium platy; firm; plastic; common distinct clay films on faces of peds; common fine and medium black concretions; slightly acid; clear smooth boundary.
- BC—41 to 54 inches; pinkish gray (7.5YR 6/2) clay; common fine, medium, and coarse light gray (N 7/0) and strong brown (7.5YR 5/8) mottles; weak very coarse prismatic structure; very firm; plastic; common fine black concretions; neutral; gradual wavy boundary.
- C—54 to 65 inches; reddish brown (5YR 4/4) clay; common fine and medium light gray (N 7/0) and red (2.5YR 5/8) mottles; weak very coarse platy structure; very firm; very plastic; common fine black concretions; neutral.

The solum ranges from 36 to 70 inches in thickness. Depth to bedrock is more than 60 inches. In some pedons rock fragments make up as much as 2 percent of the A and B horizons. Unlimed soils are very strongly acid to moderately acid in the upper part of the solum and slightly acid or neutral in the lower part of the solum and in the substratum.

The Ap horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 3 or 4.

The upper part of the Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is silty clay loam or silt loam.

The lower part of the Bt horizon has hue of 5YR, value of 4 or 5, and chroma of 4 or 6. It is silty clay loam, silty clay, or clay.

The BC horizon has hue of 7.5YR or 5YR, value of 4 to 6, and chroma of 2 to 6. It is silty clay or clay that has thin strata of silty clay loam.

The C horizon has hue of 5YR, value of 4 or 5, and chroma of 4 to 6. It is silty clay or clay.

Lindside Series

The Lindside series consists of very deep, moderately well drained soils that formed in limy and acid alluvial

material washed from soils on uplands. These soils are on flood plains throughout the survey area. They are subject to occasional flooding. Slope ranges from 0 to 3 percent.

Lindside soils are near Ashton, Chagrin, Hackers, Huntington, Melvin, Moshannon, and Sensabaugh soils. Unlike Lindside soils, the associated soils except Melvin soils are well drained. Melvin soils are poorly drained. Lindside soils are fine-silty, but Chagrin and Sensabaugh soils are fine-loamy. Unlike Lindside soils, Hackers soils are subject to rare flooding.

Typical pedon of Lindside silt loam, in Pleasants County, 150 feet west of West Virginia Route 2, near Raven Rock, between Riggs Run and Engle Run, in a field:

- Ap—0 to 11 inches; dark brown (10YR 3/3) silt loam; pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine roots; slightly acid; clear wavy boundary.
- Bw1—11 to 18 inches; brown (10YR 4/3) silt loam; moderate medium subangular blocky structure; friable; few fine roots; slightly acid; clear smooth boundary.
- Bw2—18 to 30 inches; yellowish brown (10YR 5/4) silt loam; common fine and medium strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; slightly acid; clear smooth boundary.
- Bw3—30 to 45 inches; yellowish brown (10YR 5/4) silt loam; many medium and coarse strong brown (7.5YR 5/6) and grayish brown (10YR 5/2) mottles; weak medium and coarse subangular blocky structure; firm; slightly acid; gradual smooth boundary.
- C—45 to 65 inches; brown (7.5YR 5/4) silty clay loam; common medium grayish brown (10YR 5/2) mottles; massive; firm; slightly acid.

The solum ranges from 30 to 50 inches in thickness. Depth to bedrock is more than 60 inches. In some pedons rock fragments make up as much as 5 percent of individual horizons. The soils range from moderately acid to neutral.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is silt loam or silty clay loam. Typically, it has mottles that have chroma of 2 or less within 24 inches of the surface.

The C horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam or silty clay loam.

Melvin Series

The Melvin series consists of very deep, poorly drained soils that formed in limy and acid alluvial material washed from soils on uplands. These soils are on flood plains throughout the survey area. They are subject to occasional flooding. Slope ranges from 0 to 3 percent but is generally 2 percent or less.

Melvin soils are near Ashton, Chagrin, Hackers, Huntington, Lindsides, Moshannon, and Sensabaugh soils. Unlike Melvin soils, Lindsides soils are moderately well drained and the other associated soils are well drained. Melvin soils are fine-silty, but Chagrin and Sensabaugh soils are fine-loamy. Unlike Melvin soils, Hackers soils are subject to rare flooding.

Typical pedon of Melvin silt loam, in Pleasants County, about 250 feet west of West Virginia Route 2, between Engle Run and Riggs Run near Raven Rock, in an idle field:

- Ap1—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam; few fine dark gray (10YR 4/1) mottles; moderate fine and medium granular structure; friable; common fine roots; neutral; abrupt smooth boundary.
- Ap2—4 to 9 inches; dark brown (10YR 4/3) silt loam; common fine and medium dark gray (10YR 4/1) and yellowish brown (10YR 5/6) mottles; moderate medium and coarse subangular blocky structure parting to weak medium granular; friable; common fine roots; neutral; clear smooth boundary.
- Bg—9 to 36 inches; light brownish gray (10YR 6/2) silt loam; common medium gray (10YR 6/1) and strong brown (7.5YR 5/6) mottles; weak medium and fine subangular blocky structure; friable; slightly acid; gradual wavy boundary.
- Cg—36 to 65 inches; grayish brown (10YR 5/2) silt loam; common medium and coarse gray (10YR 6/1) and strong brown (7.5YR 5/6) mottles; massive; slightly acid.

The solum ranges from 20 to 40 inches in thickness. Depth to bedrock is more than 60 inches. In some pedons rock fragments make up as much as 5 percent of the volume to a depth of 30 inches. Below that depth, they make up 0 to 20 percent of the volume. The soils are slightly acid or neutral.

The Ap horizon has hue of 10YR, value of 4, and chroma of 2 or 3. Typically, it has mottles that have chroma of 2 or less.

The B horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam or silt loam.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is silty clay loam or silt loam.

Moshannon Series

The Moshannon series consists of very deep, well drained soils that formed in limy and acid alluvial material washed from soils on uplands. These soils are on flood plains along the larger streams throughout the survey area. They are subject to occasional flooding. Slopes ranges from 0 to 3 percent.

Moshannon soils are near Chagrin, Hackers, Lindsides, Melvin, and Sensabaugh soils. Unlike Moshannon soils, Lindsides soils are moderately well drained and Melvin soils are poorly drained. Unlike Moshannon soils, Hackers soils are subject to rare flooding. Moshannon soils are fine-silty, but Chagrin and Sensabaugh soils are fine-loamy. Unlike Moshannon soils, Sensabaugh soils have a gravelly subsoil and substratum.

Typical pedon of Moshannon silt loam, in Tyler County, about 50 feet east of the intersection of County Routes 10 and 6, at Little, in a field.

- Ap—0 to 6 inches; reddish brown (5YR 4/3) silt loam; moderate medium granular structure; friable; many fine roots; slightly acid; clear smooth boundary.
- Bw1—6 to 26 inches; reddish brown (5YR 4/4) silt loam; moderate medium and coarse subangular blocky structure; friable; common fine roots; slightly acid; gradual wavy boundary.
- Bw2—26 to 38 inches; reddish brown (5YR 4/4) silt loam; weak medium and coarse subangular blocky structure; friable; few fine roots; slightly acid; gradual wavy boundary.
- C1—38 to 57 inches; reddish brown (5YR 4/4) silt loam; massive; very friable; slightly acid; clear smooth boundary.
- C2—57 to 65 inches; reddish brown (5YR 4/4) stratified loam, fine sandy loam, and silt loam; massive; very friable; slightly acid.

The solum ranges from 32 to 48 inches in thickness. Depth to bedrock is more than 60 inches. In some pedons rock fragments make up as much as 3 percent, by volume, of individual subhorizons. Unlimed soils are slightly acid or moderately acid.

The Ap horizon has hue of 7.5YR or 5YR and value and chroma of 3 or 4.

The B horizon has hue of 5YR or 2.5YR and value and chroma of 3 or 4. It is silt loam or silty clay loam.

The C horizon has hue of 5YR or 2.5YR and value and chroma of 3 or 4. It is stratified silt loam, loam, and fine sandy loam.

Otwell Series

The Otwell series consists of very deep, moderately well drained soils that formed in loess over stratified silt loam and silty clay loam lacustrine material, or in loess over mixed, alluvial material eroded from soils on

uplands underlain by shale, siltstone, and sandstone. These soils are on terraces along the major streams throughout the survey area. Slope ranges from 0 to 15 percent.

Otwell soils are near Duncannon, Gallia, Licking, and Woodsfield soils. Unlike Otwell soils, Duncannon, Gallia, and Woodsfield soils are well drained. Unlike the associated soils, Otwell soils have a fragipan. Otwell soils are fine-silty, but Gallia soils are fine-loamy and Licking and Woodsfield soils are clayey.

Typical pedon of Otwell silt loam, 8 to 15 percent slopes, in Tyler County, 1,700 feet northeast of the confluence of Buffalo Run and Middle Island Creek, in a field:

- Ap1—0 to 2 inches; brown (10YR 5/3) silt loam; weak fine granular structure; friable; many fine and very fine roots; moderately acid; abrupt smooth boundary.
- Ap2—2 to 9 inches; brown (10YR 5/3) silt loam; moderate fine and medium subangular blocky structure; friable; many fine and very fine roots; moderately acid; abrupt smooth boundary.
- Bt1—9 to 18 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine and very fine roots; common distinct clay films on faces of peds; strongly acid; clear smooth boundary.
- Bt2—18 to 27 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few fine roots; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.
- Btx1—27 to 52 inches; yellowish brown (10YR 5/6) silt loam; common fine light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to weak medium platy; firm and brittle; many medium and coarse black concretions; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.
- Btx2—52 to 65 inches; yellowish brown (10YR 5/8) silty clay loam; few fine strong brown (7.5YR 4/6) and light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; firm and brittle; common medium and coarse black concretions; common distinct clay films on faces of peds; strongly acid.

The solum ranges from 40 to 80 inches in thickness. Depth to bedrock is more than 60 inches. The fragipan and mottles that have chroma of 2 or less are at a depth of 24 to 36 inches. In some pedons rock fragments range to 5 percent, by volume, in the Btx horizon. Some pedons have a C horizon where rock fragments make up as much as 15 percent of the volume. Unlimed soils are moderately acid to very strongly acid.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 3. It is silt loam or silty clay loam.

The Bt horizon has hue of 10YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or silty clay loam.

The Bx horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 4 to 8. In some pedons the Bx horizon is in the lower part and the BC horizon that is in some pedons have hue of 5YR. They are clay loam, loam, silt loam, or silty clay loam.

Sensabaugh Series

The Sensabaugh series consists of very deep, well drained soils that formed in limy and acid alluvial material washed from soils on uplands. These soils are on narrow flood plains along small streams and on alluvial fans at the mouth of hollows throughout the survey area. They are subject to occasional flooding along small streams and to rare flooding on alluvial fans. Slope ranges from 0 to 3 percent.

Sensabaugh soils are near Chagrin, Gilpin, Hackers, Lindsides, Melvin, Moshannon, Upshur, and Vandalia soils. Unlike Sensabaugh soils, Lindsides soils are moderately well drained and Melvin soils are poorly drained. Sensabaugh soils are fine-loamy, and Hackers, Lindsides, Melvin, and Moshannon soils are fine-silty and Upshur and Vandalia soils are clayey. Unlike Chagrin, Hackers, and Moshannon soils, Sensabaugh soils have a gravelly subsoil and substratum. Gilpin, Upshur, and Vandalia soils are not subject to flooding.

Typical pedon of Sensabaugh silt loam, in Tyler County, about 150 yards southwest of the junction of Gorrell Run and Sellers Road, about 1 1/2 miles southwest of Middlebourne, in a meadow:

- Ap—0 to 8 inches; dark reddish brown (5YR 3/3) silt loam; moderate medium granular structure; friable; many fine roots; neutral; clear wavy boundary.
- Bw1—8 to 18 inches; dark reddish brown (5YR 3/4) silt loam; moderate medium and coarse subangular blocky structure; friable; common fine roots; 10 percent shale and sandstone fragments; moderately acid; clear wavy boundary.
- Bw2—18 to 33 inches; dark reddish brown (5YR 3/4) very gravelly silt loam; moderate medium and coarse subangular blocky structure; friable; few fine roots; 35 percent shale and sandstone fragments; moderately acid; clear wavy boundary.
- C1—33 to 41 inches; dark reddish brown (5YR 3/4) very gravelly clay loam; massive; friable; few fine roots; 50 percent shale and sandstone fragments; slightly acid; clear wavy boundary.
- C2—41 to 65 inches; reddish brown (5YR 4/3) gravelly clay loam; massive; friable; 30 percent shale and sandstone fragments; moderately acid.

The solum ranges from 24 to 40 inches in thickness. Depth to bedrock is more than 60 inches. Fragments of shale and sandstone range from 0 to 15 percent, by

volume, in the A horizon, 5 to 40 percent in the B horizon, and 30 to 70 percent in the C horizon. The soils are moderately acid to neutral.

The Ap horizon has hue of 5YR, value of 3 or 4, and chroma of 2 or 3.

The B horizon has hue of 5YR and value and chroma of 3 or 4. Fine earth material is loam, clay loam, or silt loam.

The C horizon has hue of 5YR and value and chroma of 3 or 4. Fine earth material is loam, clay loam, fine sandy loam, or silt loam.

Taggart Series

The Taggart series consists of very deep, somewhat poorly drained soils that formed in stream-deposited materials and glacial outwash. These soils are on terraces of the Ohio River. Slope ranges from 0 to 3 percent.

Taggart soils are near Glenford, Lakin, and Wheeling soils. Unlike Taggart soils, Glenford soils are moderately well drained, Lakin soils are excessively drained, and Wheeling soils are well drained. Taggart soils are fine-silty, but Lakin soils are sandy and Wheeling soils are fine-loamy.

Typical pedon of Taggart silt loam, in Pleasants County, 160 feet east of American Cyanamid Company electric substation and 180 feet south of West Virginia Route 2, in Willow Island, in a meadow:

Ap1—0 to 4 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

Ap2—4 to 11 inches; dark grayish brown (10YR 4/2) silt loam; moderate fine and medium subangular blocky structure; friable; common fine roots; slightly acid; clear smooth boundary.

Bt—11 to 20 inches; pale brown (10YR 6/3) silt loam; common fine and medium light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure parting to moderate medium subangular blocky; friable; common distinct clay films on faces of peds; few fine roots; strongly acid; clear smooth boundary.

Btg—20 to 34 inches; light brownish gray (10YR 6/2) silty clay loam; common fine yellowish brown (10YR 5/6) and grayish brown (10YR 5/2) mottles; moderate very coarse prismatic structure parting to weak medium and coarse subangular blocky; friable to firm; slightly plastic; few fine roots; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.

BCg—34 to 46 inches; grayish brown (10YR 5/2) silty clay loam; many fine yellowish brown (10YR 5/6) mottles; weak very coarse prismatic structure parting to weak medium and coarse subangular blocky;

friable; slightly plastic; few fine roots; moderately acid; gradual wavy boundary.

Cg—46 to 65 inches; dark grayish brown (10YR 4/2) clay loam; common medium strong brown (7.5YR 5/8) and few fine light gray (10YR 7/2) mottles; weak medium and coarse platy structure; friable; plastic; slightly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is more than 60 inches. Rock fragments range from 0 to 20 percent, by volume, in the lower part of the B horizon and in the C horizon. Unlimed soils are moderately acid to very strongly acid in the solum and slightly acid in the C horizon.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2.

The Bt, Btg, and BC horizons have hue of 10YR, value of 5 or 6, and chroma of 2 to 4. They are silty clay loam, silt loam, clay loam, or loam.

The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 or 2. Fine earth material is clay loam or loam.

Upshur Series

The Upshur series consists of deep, well drained soils that formed in material weathered from shale. These soils are on ridgetops, benches, and hillsides throughout the survey area. Slope ranges from 8 to 70 percent.

Upshur soils are near Cedar creek, Duncannon, Gilpin, Sensabaugh, Vandalia, and Woodsfield soils. Unlike Upshur soils, Cedar creek soils have been disturbed by surface mining. Upshur soils are clayey. Duncannon soils are coarse-silty, and Gilpin and Sensabaugh soils are fine-loamy. Upshur soils are not subject to flooding, but Sensabaugh soils are subject to occasional or rare flooding. Upshur soils have more clay in the upper part of the solum than that of Vandalia soils. Unlike Upshur soils, Woodsfield soils, have a thick, silty surface layer.

Typical pedon of Upshur silty clay loam, in an area of Gilpin-Upshur complex, 15 to 25 percent slopes, in Tyler County, 1/2 mile north of West Virginia Route 23 and 200 yards west of Labell Run, in woodland:

Oi—2 to 0 inches; slightly decayed leaf litter.

A—0 to 3 inches; dark brown (7.5YR 3/4) silty clay loam, brown (7.5YR 5/4) dry; moderate medium granular structure; friable; many fine and medium roots; 5 percent siltstone fragments; very strongly acid; abrupt wavy boundary.

Bt1—3 to 15 inches; reddish brown (5YR 4/4) silty clay; moderate medium and coarse subangular blocky structure; firm; plastic; common fine and medium roots; common distinct clay films on faces of peds; 5 percent siltstone fragments; very strongly acid; clear wavy boundary.

Bt2—15 to 38 inches; reddish brown (2.5YR 4/4) silty clay; strong fine and medium subangular blocky structure; firm; very plastic; few fine roots; few distinct clay films on faces of peds; very strongly acid; clear wavy boundary.

BC—38 to 44 inches; dark reddish brown (2.5YR 3/4) clay; moderate fine subangular blocky structure; firm; very plastic; few fine roots; 10 percent shale fragments; very strongly acid; abrupt smooth boundary.

Cr—44 inches; yellowish red (5YR 5/6) weathered shale.

The solum ranges from 26 to 48 inches in thickness. Depth to bedrock ranges from 40 to 60 inches.

Fragments of weathered shale and siltstone range from 0 to 10 percent, by volume, in the solum and from 5 to 60 percent in the substratum. Unlimed soils range from very strongly acid to slightly acid in the substratum.

The Ap and A horizons have hue of 7.5YR or 5YR and value and chroma of 3 or 4. It is silty clay loam or silty clay.

The Bt and BC horizons have hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 3 to 6. They are clay or silty clay.

The Cr horizon is weathered shale or siltstone.

Vandalia Series

The Vandalia series consists of very deep, well drained soils that formed in colluvial material from upland soils underlain by shale, siltstone, and sandstone. These soils are on colluvial foot slopes and fans.

Vandalia soils are near Gilpin, Sensabaugh, and Upshur soils. Vandalia soils are clayey, but Gilpin and Sensabaugh soils are fine-loamy. Sensabaugh soils are subject to occasional or rare flooding. Vandalia soils have less clay in the upper part of the subsoil than in that of Upshur soils.

Typical pedon of Vandalia silt loam, 15 to 25 percent slopes, very stony, in Pleasants County, about 800 feet east of West Virginia Route 2, about 1/2 mile south of the junction of West Virginia Route 2 and Spring Run, in a pasture:

Ap—0 to 6 inches; dark brown (7.5YR 4/2) silt loam; moderate medium granular and very fine subangular blocky structure; friable; common fine roots; 5 percent sandstone and shale fragments; neutral; clear smooth boundary.

Bt1—6 to 25 inches; reddish brown (5YR 4/3) silty clay loam; strong fine subangular blocky structure; firm, slightly sticky and plastic; few fine roots; common distinct clay films on faces of peds; 10 percent sandstone and shale fragments; moderately acid; clear wavy boundary.

Bt2—25 to 35 inches; reddish brown (5YR 4/4) channery silty clay loam; common fine and medium strong brown (7.5YR 5/6) mottles; moderate medium and

coarse subangular blocky structure; firm, slightly sticky and plastic; common distinct clay films on faces of peds; common fine black concretions; 25 percent shale and siltstone fragments; moderately acid; clear wavy boundary.

Bt3—35 to 45 inches; reddish brown (5YR 4/4) channery silty clay loam; common medium and coarse strong brown (7.5YR 5/6) mottles; weak medium and coarse subangular blocky structure; firm, slightly sticky and plastic; few distinct clay films on faces of peds; common fine black concretions; 30 percent shale and siltstone fragments; slightly acid; gradual wavy boundary.

C—45 to 65 inches; reddish brown (5YR 4/4) channery silty clay loam; massive; firm, slightly sticky and plastic; few fine black concretions; 35 percent shale fragments; neutral.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is more than 60 inches. Fragments of shale, siltstone, and sandstone range from 5 to 15 percent, by volume, in the upper part of the solum, 5 to 30 percent in the lower part of the solum, and 15 to 40 percent in the C horizon. Unlimed soils are strongly acid or moderately acid in the upper part of the solum and range from moderately acid to neutral in the lower part of the solum and in the substratum.

The A horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 2 to 4.

The upper part of the Bt horizon has hue of 5YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is silty clay loam or silty clay.

The lower part of the Bt horizon has hue of 5YR, value 4, and chroma of 3 to 6. Fine earth material is silty clay loam or silty clay. Some pedons have pockets that are mottled with chroma of 2 or less.

The C horizon has hue of 5YR, value of 4 to 6, and chroma of 3 to 6. Fine earth material is silty clay loam or silty clay.

Wheeling Series

The Wheeling series consists of very deep, well drained soils that formed in loamy material. These soils are on terraces along the Ohio River. Slope ranges from 0 to 8 percent.

Wheeling soils are near Ashton, Glenford, Lakin, and Taggart soils. Glenford soils are moderately well drained, Lakin soils are excessively drained, and Taggart soils are somewhat poorly drained. Wheeling soils are not subject to flooding, but Ashton soils are subject to rare flooding. Wheeling soils are fine-loamy, and Lakin soils are sandy. Ashton, Glenford, and Taggart soils are fine-silty.

Typical pedon of Wheeling silt loam, 0 to 3 percent slopes, in Pleasants County, about 600 feet north of Henry Camp Road and about 1/8 mile southeast of Belmont, in a hayfield:

- Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; friable; many fine roots; moderately acid; abrupt smooth boundary.
- Bt1—10 to 20 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium subangular blocky structure; friable; few distinct clay films on faces of peds; common fine roots; moderately acid; clear wavy boundary.
- Bt2—20 to 33 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium and coarse subangular blocky structure; friable; few distinct clay films on faces of peds; few fine roots; moderately acid; gradual wavy boundary.
- BC—33 to 52 inches; yellowish brown (10YR 5/6) silt loam; moderate medium and coarse subangular blocky structure; moderately acid; clear wavy boundary.
- C—52 to 65 inches; yellowish brown (10YR 5/6) loam; massive; friable; moderately acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is more than 60 inches. In some pedons the content of gravel in the substratum is as much as 15 percent. Reaction is moderately acid throughout.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3.

The B horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. Fine earth fraction is loam, sandy loam, loamy sand, or sand. In some pedons the C horizon is stratified.

Woodsfield Series

The Woodsfield series consists of deep and very deep, well drained soils that formed in the silt loam mantle and the underlying clayey material that weathered mainly from soft clay shales. These soils are on ridgetops near the Ohio River and Middle Island Creek. Slope ranges from 3 to 15 percent.

Woodsfield soils are near Duncannon, Gallia, Gilpin, Licking, Otwell, and Upshur soils. Woodsfield soils are clayey, but Duncannon soils are coarse-silty, Gallia and Gilpin soils are fine-loamy, and Otwell soils are fine-silty. Unlike Woodsfield soils, Licking and Otwell soils are moderately well drained. Unlike Woodsfield soils, Otwell soils have a fragipan. Unlike Upshur soils, Woodsfield soils have a thick, silty surface layer.

Typical pedon of Woodsfield silt loam, 3 to 15 percent slopes, in Pleasants County, about 1 mile southeast of the bridge over Middle Island Creek at Arvilla and about 200 yards east of Big Run, on a wooded ridgetop:

Oi—1 to 0 inches; pine litter.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam; weak medium subangular blocky structure parting to moderate medium granular; friable; many fine and medium roots; strongly acid; abrupt wavy boundary.

BA—7 to 14 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common fine and medium roots; very strongly acid; clear wavy boundary.

Bt1—14 to 20 inches; dark yellowish brown (10YR 4/6) silty clay loam; moderate medium subangular blocky structure; friable; common fine roots; few distinct clay films on faces of peds; strongly acid; clear wavy boundary.

2Bt2—20 to 26 inches; yellowish red (5YR 4/6) silty clay; strong fine and medium subangular blocky structure; very firm; plastic; common distinct clay films on faces of peds; strongly acid; clear wavy boundary.

2Bt3—26 to 41 inches; yellowish red (5YR 4/6) clay; strong fine and medium subangular blocky structure; very firm; plastic; common distinct clay films on faces of peds; strongly acid; abrupt wavy boundary.

2BC—41 to 50 inches; yellowish red (5YR 4/6) silty clay loam; moderate coarse platy structure parting to weak fine subangular blocky; fine and medium pinkish gray (5YR 6/2) and gray (5YR 6/1) mottles; moderately acid; clear wavy boundary.

2C—50 to 65 inches; reddish brown (5YR 4/4) silty clay; moderate fine and medium platy relict rock structure; very firm; plastic; slightly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is 40 to 72 inches. The silt loam mantle ranges from 14 to 26 inches in thickness. Rock fragments range from 0 to 15 percent, by volume, in the lower part of the solum and from 0 to 40 percent in the substratum. Reaction is very strongly acid or strongly acid in the upper part of the solum and ranges from strongly acid to neutral in the lower part of the solum and from moderately acid to mildly alkaline in the substratum.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4.

The BA horizon has hue of 10YR to 5YR, value of 3 to 5, and chroma of 3 to 6.

The Bt horizon has hue of 10YR to 5YR, value of 3 to 5, and chroma of 3 to 6. It is silt loam or silty clay loam.

The 2Bt and 2BC horizons have hue of 5YR to 10R, value of 3 to 5, and chroma of 3 to 6. Fine earth material is silty clay loam, silty clay, or clay.

The 2C horizon has color and texture similar to those of the 2Bt horizon.

Formation of the Soils

The origin and development of the soils in Pleasants and Tyler Counties are discussed in this section. The five factors of soil formation are listed, and their influence on the soils is described. Morphology of the soils is described as related to horizon nomenclature and the processes of horizon development.

Factors of Soil Formation

The soils of Pleasants and Tyler Counties have resulted from the interaction of five major factors of soil formation: parent material, time, climate, living organisms, and topography. Each factor modifies the effect of the other factors. These factors influence the two main processes of soil formation: the accumulation of parent material and the differentiation of horizons within the profile. The horizons of the soils are faint to distinct, depending on the gains, losses, and alterations that have taken place. The main factors that have produced differences among the soils are parent material, topography, and time. The influence of climate and living organisms generally is shown throughout broad areas, and is relatively uniform throughout the survey area.

Parent Material, Time, and Climate

The properties of the parent material strongly influence the length of time required for soil formation and the nature of the soils produced. The soils in the survey area formed in residual, colluvial, and alluvial materials. Most of the soils formed in residual material from interbedded shale, siltstone, and sandstone.

Most of the parent material in the survey area is residual material from rocks of the Dunkard group. The dominant residual soils are Gilpin and Upshur soils. Residual material is the oldest parent material in the survey area. However, clayey material, resistant rock, and steepness of slope have retarded soil-forming factors. Consequently, some of the soils that formed under these conditions have a less developed profile than some of the soils that formed in younger materials.

Colluvial material is along foot slopes and at the head of drainageways. This material has moved downslope from acid, lime-influenced residual soils. Vandalia soils, below Gilpin and Upshur soils on the landscape, formed in colluvium.

The parent material on terraces and flood plains was washed from acid, lime-influenced soils on uplands. The soil-forming processes have acted on this material for a considerable time. Many additions, losses, and alterations have taken place. Thus, Gallia and Otwell soils have a moderately well developed profile. The alluvial deposits on flood plains are the youngest parent material in the survey area. Most of this material is physically well suited to soil formation, but the soil-forming processes have acted on it for little time. Thus, the soils on flood plains generally exhibit a weakly developed profile. Chagrin and Moshannon soils are examples of soils on flood plains.

Climate generally is relatively uniform throughout the survey area. Consequently, it has not caused any major differences in the soils, but is a major factor in the development of soil horizons. A detailed description of climate is given in the section "General Nature of the Survey Area."

Living Organisms

Living organisms, including vegetation, animals, bacteria, and fungi, are important in soil formation. The kind and amount of vegetation generally are responsible for the amount of organic matter, color of the surface layer, and, in part, for the amount of nutrients. Earthworms and burrowing animals help to keep the soil open and porous, and, by moving the soil to the surface, they mix organic and mineral matter. Bacteria and fungi decompose organic matter, thus releasing nutrients for use as food by plants. Man has greatly influenced the surface layer by such activities as clearing the forest and plowing the soil.

Topography

Topography affects soil formation through its effect on the amount of water moving through the soil, the amount of runoff, and erosion.

Large amounts of water have moved through gently sloping and strongly sloping soils. This condition favors the formation of deep, moderately well developed or well developed soils. On the steep and very steep hillsides, less water moves through the soils and thus more water runs off. In addition, the soil material is washed away almost as rapidly as it forms. In many places soils on the

steeper hillsides are shallower to bedrock than soils on gentler slopes.

Topography in this survey area favors the formation of soils on flood plains and young terraces, and formation is progressing at a rapid rate.

Morphology of the Soils

The results of soil-forming processes can be observed in the different layers, or soil horizons, in the soil profile. The profile extends from the soil surface downward to materials that have been little changed by soil-forming processes. Most soils have three major horizons, the A, B, and C horizons. These horizons can be further subdivided by the use of numbers and letters to indicate changes within the major horizon.

The A horizon, or surface layer, is the layer of maximum accumulation of organic matter. It is also the layer of maximum leaching, or eluviation, of clay and iron.

The B horizon, or subsoil, underlies the A horizon. It is the horizon of maximum accumulation, or illuviation, of clay, iron, aluminum, or other compounds leached from the surface layer. It commonly has a blocky structure and generally is firmer and lighter in color than the A horizon.

The C horizon, or substratum, is below the A and B horizons. It consists of material that has been modified by weathering but little altered by the soil-forming processes.

In the survey area, the more important processes involved in the formation of soil horizons are the accumulation of organic matter, the reduction and transfer of iron, the formation and translocation of clay minerals, and the formation of structure. Such processes have been continually taking place for thousands of years.

On most of the soils on uplands, the B horizon is yellowish brown, strong brown, and reddish brown. Iron oxides have been the main cause of these colors. The horizon has a blocky structure, and generally has translocated clay minerals.

A dense, brittle layer called a fragipan has formed in the B horizon of some moderately well drained soils on terraces. This layer is mottled and slowly or very slowly permeable to water and air.

Moderately well drained to poorly drained soils commonly have gray colors. These colors are the result of gleying, a process of intense reduction of iron, during soil formation.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

Ablation till. Loose, permeable till deposited during the final downwasting of glacial ice. Lenses of crudely sorted sand and gravel are common.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 40-inch profile or to a limiting layer is expressed as

	<i>Inches</i>
Very low.....	0 to 2.4
Low.....	2.4 to 3.2
Moderate.....	3.2 to 5.2
High.....	more than 5.2

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K),

expressed as a percentage of the total cation exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedding system. A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on the contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Broad-base terrace. A ridge-type terrace built to control erosion by diverting runoff along the contour at a nonscouring velocity. The terrace is 10 to 20 inches high and 15 to 30 feet wide and has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Catsteps. Very small, irregular terraces on steep hillsides, especially in pasture, formed by the trampling of cattle or the slippage of saturated soil.

Cement rock. Shaly limestone used in the manufacture of cement.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in

diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Congeliturbate. Soil material disturbed by frost action.

Conservation tillage. A tillage and planting system in which crop residue covers at least 30 percent of the soil surface after planting. Where soil erosion by wind is the main concern, the system leaves the equivalent of at least 1,000 pounds per acre of flat small-grain residue on the surface during the critical erosion period.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are *Loose*. Noncoherent when dry or moist; does not hold together in a mass.

Friable. When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm. When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic. When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky. When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard. When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft. When dry, breaks into powder or individual grains under very slight pressure.

Cemented. Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat). Fecal material deposited in water by aquatic organisms.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained. Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained. Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained. Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are

commonly medium textured. They are mainly free of mottling.

Moderately well drained. Water is removed from the soil somewhat slowly during some periods.

Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained. Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained. Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained. Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Erosion pavement. A layer of gravel or stones that remains on the surface after fine particles are removed by sheet or rill erosion.

Esker (geology). A narrow, winding ridge of stratified gravelly and sandy drift deposited by a stream flowing in a tunnel beneath a glacier.

Excess alkali (in tables). Excess exchangeable sodium in the soil. The resulting poor physical properties restrict the growth of plants.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Excess sulfur (in tables). Excessive amount of sulfur in the soil. The sulfur causes extreme acidity if the soil is drained, and the growth of most plants is restricted.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a

soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial melt water.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial melt water. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon. An organic layer of fresh and decaying plant residue.

A horizon. The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon. The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon. The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or

browner colors than those in the A horizon; or (4) a combination of these.

C horizon. The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon. Soft, consolidated bedrock beneath the soil.

R layer. Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be

limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2.....	very low
0.2 to 0.4.....	low
0.4 to 0.75.....	moderately low
0.75 to 1.25.....	moderate
1.25 to 1.75.....	moderately high
1.75 to 2.5.....	high
More than 2.5.....	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are
Border. Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin. Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding. Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation. Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle). Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow. Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler. Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation. Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding. Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame (geology). An irregular, short ridge or hill of stratified glacial drift.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance *few*, *common*, and *many*; size *fine*, *medium*, and *coarse*; and contrast *faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark colored, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash, glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material).

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water and air to move through the profile. Permeability is measured as the number of inches per hour that

water moves through the saturated soil. Terms describing permeability are:

Very slow.....	less than 0.06 inch
Slow.....	0.06 to 0.2 inch
Moderately slow.....	0.2 to 0.6 inch
Moderate.....	0.6 inch to 2.0 inches
Moderately rapid.....	2.0 to 6.0 inches
Rapid.....	6.0 to 20 inches
Very rapid.....	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting (in tables). Pits caused by melting ground ice. They form on the soil after plant cover is removed.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor filter (in tables). Because of rapid permeability the soil may not adequately filter effluent from a waste disposal system.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or

browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as

	pH
Extremely acid.....	below 4.5
Very strongly acid.....	4.5 to 5.0
Strongly acid.....	5.1 to 5.5
Moderately acid.....	5.6 to 6.0
Slightly acid.....	6.1 to 6.5
Neutral.....	6.6 to 7.3
Mildly alkaline.....	7.4 to 7.8
Moderately alkaline.....	7.9 to 8.4
Strongly alkaline.....	8.5 to 9.0
Very strongly alkaline.....	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil

before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables.) Water that is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Much has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Sloughed till. Water-saturated till that has flowed slowly downhill from its original place of deposit by glacial ice. It may rest on other till, on glacial outwash, or on a glaciolacustrine deposit.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $\text{Ca}^{++} + \text{Mg}^{++}$. The degrees of sodicity are

	SAR
Slight.....	less than 13:1
Moderate.....	13-30:1
Strong.....	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millime- ters
Very coarse sand.....	2.0 to 1.0
Coarse sand.....	1.0 to 0.5
Medium sand.....	0.5 to 0.25
Fine sand.....	0.25 to 0.10
Very fine sand.....	0.10 to 0.05
Silt.....	0.05 to 0.002
Clay.....	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terminal moraine. A belt of thick glacial drift that generally marks the termination of important glacial advances.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Too arid (in tables). The soil is dry most of the time, and vegetation is difficult to establish.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Toxicity (in tables). Excessive amount of toxic substances, such as sodium or sulfur, that severely hinder establishment of vegetation or severely restrict plant growth.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve. A sedimentary layer of a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by melt water streams, in glacial lake or other body of still water in front of a glacier.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION
[Recorded in the period 1951-80 at Bens Run, West Virginia]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
	<u>°F</u>	<u>°F</u>	<u>°F</u>	<u>°F</u>	<u>°F</u>	<u>Units</u>	<u>In</u>	<u>In</u>	<u>In</u>		<u>In</u>
January----	39.4	19.2	29.3	70	-6	53	3.36	1.80	4.73	9	8.8
February---	42.4	20.2	31.3	68	-7	75	2.76	1.43	3.92	7	3.0
March-----	53.7	29.8	41.7	83	9	144	3.64	2.16	4.96	9	1.5
April-----	65.8	38.9	52.4	87	20	378	3.86	2.80	4.88	9	.1
May-----	75.5	47.5	61.5	91	28	667	3.91	2.18	5.44	9	.0
June-----	82.7	56.4	69.6	95	39	888	4.01	2.18	5.61	8	.0
July-----	85.7	60.7	73.2	97	43	1,029	4.25	2.83	5.54	8	.0
August-----	84.4	59.3	71.9	95	44	989	4.52	2.14	6.56	7	.0
September--	78.5	52.3	65.4	93	35	762	3.40	2.04	4.61	6	.0
October----	67.4	40.1	53.8	85	21	436	2.68	1.13	4.00	6	.0
November---	54.3	32.1	43.2	78	12	139	2.97	1.89	3.94	8	.8
December---	43.5	24.1	33.8	71	0	70	3.25	1.91	4.45	9	2.3
Year:											
Average---	64.4	40.0	52.3	---	---	---	---	---	---	---	---
Extreme---	---	---	---	99	-8	---	---	---	---	---	---
Total-----	---	---	---	---	---	5,630	42.63	37.58	47.42	95	16.5

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-80 at Bens Run,
West Virginia]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	April 21	May 3	May 22
2 years in 10 later than--	April 15	April 26	May 16
5 years in 10 later than--	April 3	April 18	May 4
First freezing temperature in fall:			
1 year in 10 earlier than--	October 19	October 9	September 27
2 years in 10 earlier than--	October 25	October 15	October 2
5 years in 10 earlier than--	November 4	October 25	October 10

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-80 at Bens Run,
West Virginia]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	<u>Days</u>	<u>Days</u>	<u>Days</u>
9 years in 10	187	167	132
8 years in 10	197	175	141
5 years in 10	214	189	158
2 years in 10	232	203	176
1 year in 10	241	210	185

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Pleasants County	Tyler County	Total--	
		Acres	Acres	Area Acres	Extent Pct
AsA	Ashton silt loam, 0 to 3 percent slopes-----	185	115	300	0.1
AsB	Ashton silt loam, 3 to 8 percent slopes-----	50	170	220	0.1
CeE	Cedarcreek channery silt loam, steep, stony-----	195	0	195	0.1
Cg	Chagrin loam-----	1,000	410	1,410	0.6
DuC	Duncannon silt loam, 8 to 15 percent slopes-----	380	75	455	0.2
DuD	Duncannon silt loam, 15 to 25 percent slopes-----	420	45	465	0.2
GaC	Gallia silt loam, 8 to 15 percent slopes-----	560	1,455	2,015	0.8
GaD	Gallia silt loam, 15 to 25 percent slopes-----	275	85	360	0.1
GpC	Gilpin-Upshur complex, 8 to 15 percent slopes-----	845	2,115	2,960	1.2
GpD	Gilpin-Upshur complex, 15 to 25 percent slopes-----	10,835	23,595	34,430	13.7
GpE	Gilpin-Upshur complex, 25 to 35 percent slopes-----	7,820	18,420	26,240	10.5
GpF	Gilpin-Upshur complex, 35 to 70 percent slopes-----	39,740	84,360	124,100	49.5
GwC3	Gilpin-Upshur complex, 8 to 15 percent slopes, severely eroded-----	60	540	600	0.2
GwD3	Gilpin-Upshur complex, 15 to 25 percent slopes, severely eroded-----	3,350	4,720	8,070	3.2
GwE3	Gilpin-Upshur complex, 25 to 35 percent slopes, severely eroded-----	1,790	5,495	7,285	2.9
GxF	Gilpin-Upshur-Rock outcrop complex, 35 to 70 percent slopes	3,705	1,975	5,680	2.3
Gy	Glenford silt loam-----	125	75	200	0.1
HaA	Hackers silt loam, 0 to 3 percent slopes-----	55	250	305	0.1
HaB	Hackers silt loam, 3 to 8 percent slopes-----	245	1,170	1,415	0.6
Hn	Huntington silt loam-----	460	295	755	0.3
LaC	Lakin loamy fine sand, 8 to 15 percent slopes-----	200	0	200	0.1
LkC	Licking silt loam, 8 to 15 percent slopes-----	190	10	200	0.1
Ln	Lindside silt loam-----	140	290	430	0.2
Me	Melvin silt loam-----	90	180	270	0.1
Mo	Moshannon silt loam-----	270	1,330	1,600	0.6
OtA	Otwell silt loam, 0 to 3 percent slopes-----	60	170	230	0.1
OtB	Otwell silt loam, 3 to 8 percent slopes-----	395	715	1,110	0.4
OtC	Otwell silt loam, 8 to 15 percent slopes-----	550	1,650	2,200	0.9
Sn	Sensabaugh silt loam-----	2,335	6,765	9,100	3.6
Ta	Taggart silt loam-----	80	50	130	0.1
UpC	Upshur silty clay loam, 8 to 15 percent slopes-----	365	580	945	0.4
VaD	Vandalia silt loam, 15 to 25 percent slopes-----	2,220	4,675	6,895	2.7
VbD	Vandalia silt loam, 15 to 25 percent slopes, very stony---	660	100	760	0.3
WhA	Wheeling silt loam, 0 to 3 percent slopes-----	105	240	345	0.1
WhB	Wheeling silt loam, 3 to 8 percent slopes-----	130	100	230	0.1
WnB	Wheeling-Urban land complex, 0 to 8 percent slopes-----	1,100	515	1,615	0.6
WoC	Woodsfield silt loam, 3 to 15 percent slopes-----	175	355	530	0.2
W	Water-----	3,960	2,670	6,630	2.6
	Total-----	85,120	165,760	250,880	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
AsA	Ashton silt loam, 0 to 3 percent slopes
AsB	Ashton silt loam, 3 to 8 percent slopes
Cg	Chagrin loam
Gy	Glenford silt loam
HaA	Hackers silt loam, 0 to 3 percent slopes
HaB	Hackers silt loam, 3 to 8 percent slopes
Hn	Huntington silt loam
Ln	Lindside silt loam
Mo	Moshannon silt loam
OtA	Otwell silt loam, 0 to 3 percent slopes
Sn	Sensabaugh silt loam
WhA	Wheeling silt loam, 0 to 3 percent slopes

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Oats	Wheat	Grass-legume hay	Alfalfa hay	Kentucky bluegrass
		<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Tons</u>	<u>Tons</u>	<u>AUM*</u>
AsA----- Ashton	I	140	80	50	5.0	5.0	5.5
AsB----- Ashton	IIe	130	80	45	5.0	5.0	5.5
CeE----- Cedarcreek	VIIIs	---	---	---	---	---	---
Cg----- Chagrin	IIw	125	75	45	4.5	5.0	5.5
DuC----- Duncannon	IIIe	110	65	35	3.5	4.5	5.0
DuD----- Duncannon	IVe	95	60	30	3.0	4.0	4.5
GaC----- Gallia	IIIe	100	65	40	4.0	4.0	5.0
GaD----- Gallia	IVe	80	60	35	3.5	3.5	4.5
GpC----- Gilpin-Upshur	IIIe	90	60	35	3.0	4.0	4.5
GpD----- Gilpin-Upshur	IVe	85	60	35	3.0	4.0	4.0
GpE----- Gilpin-Upshur	VIe	---	---	---	---	---	3.5
GpF----- Gilpin-Upshur	VIIe	---	---	---	---	---	---
GwC3----- Gilpin-Upshur	IVe	85	60	35	3.0	3.5	4.0
GwD3----- Gilpin-Upshur	VIe	---	---	---	---	---	3.5
GwE3----- Gilpin-Upshur	VIIe	---	---	---	---	---	---
GxF**----- Gilpin-Upshur- Rock outcrop	VIIIs	---	---	---	---	---	---
Gy----- Glenford	IIw	110	75	40	4.5	4.5	5.0
HaA----- Hackers	I	135	80	50	3.5	5.0	5.5
HaB----- Hackers	IIe	130	80	50	3.5	5.0	5.5

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Oats	Wheat	Grass-legume hay	Alfalfa hay	Kentucky bluegrass
		<u>Bu</u>	<u>Bu</u>	<u>Bu</u>	<u>Tons</u>	<u>Tons</u>	<u>AUM*</u>
Hn----- Huntington	IIw	135	80	50	3.5	5.0	5.5
LaC----- Lakin	IVs	70	30	30	2.0	3.0	2.0
LkC----- Licking	IVe	100	75	40	4.0	4.0	4.0
Ln----- Lindside	IIw	125	80	40	3.5	4.5	5.0
Me----- Melvin	IIIw	80	55	30	3.5	3.0	4.5
Mo----- Moshannon	IIw	125	75	45	4.5	5.0	5.5
OtA----- Otwell	IIw	105	65	50	3.5	3.5	4.5
OtB----- Otwell	IIe	95	60	45	3.0	3.0	4.5
OtC----- Otwell	IIIe	85	55	40	3.0	3.0	4.5
Sn----- Sensabaugh	IIw	125	75	45	3.5	3.0	5.5
Ta----- Taggart	IIw	100	70	55	4.5	4.0	4.5
UpC----- Upshur	IVe	90	60	35	3.0	4.0	4.5
VaD----- Vandalia	IVe	90	55	30	2.5	4.0	4.0
VbD----- Vandalia	VIIIs	---	---	---	---	---	---
WhA----- Wheeling	I	125	75	45	4.5	4.5	5.5
WhB----- Wheeling	IIe	125	75	45	4.5	4.5	5.5
WoC----- Woodsfield	IIIe	95	60	40	4.5	4.5	4.5

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Dashes indicate no acreage)

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		<u>Acres</u>	<u>Acres</u>	<u>Acres</u>	<u>Acres</u>
I:					
Pleasants County-----	345	---	---	---	---
Tyler County-----	605	---	---	---	---
II:					
Pleasants County-----	5,290	820	4,470	---	---
Tyler County-----	11,540	2,155	9,305	---	---
III:					
Pleasants County-----	2,600	2,510	90	---	---
Tyler County-----	5,830	5,650	180	---	---
IV:					
Pleasants County-----	14,565	14,365	---	200	---
Tyler County-----	29,530	29,530	---	---	---
V:					
Pleasants County-----	---	---	---	---	---
Tyler County-----	---	---	---	---	---
VI:					
Pleasants County-----	11,170	11,170	---	---	---
Tyler County-----	23,140	23,140	---	---	---
VII:					
Pleasants County-----	46,090	41,530	---	4,560	---
Tyler County-----	91,930	89,855	---	2,075	---
VIII:					
Pleasants County-----	---	---	---	---	---
Tyler County-----	---	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Average annual growth**		
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Cubic feet/ac	Board feet/ac	Cords feet/ac
AsA, AsB----- Ashton	5A	Slight	Slight	Slight	Moderate	Northern red oak----	85	67	285	0.90
						Yellow-poplar-----	95	98	510	1.00
						Silver maple-----	95	46	---	---
CeE----- Cedarcreek	4X	Moderate	Moderate	Moderate	Moderate	Northern red oak----	80	62	250	0.80
						Eastern white pine--	94	174	740	---
						Yellow-poplar-----	105	115	795	1.50
						American sycamore----	90	---	---	---
						Black locust-----	100	---	---	---
						Virginia pine-----	---	---	---	---
Cg----- Chagrin	5A	Slight	Slight	Slight	Severe	Northern red oak----	86	68	290	0.90
						Yellow-poplar-----	96	100	525	1.10
						American sycamore----	---	---	---	---
						Silver maple-----	---	---	---	---
						Boxelder-----	---	---	---	---
DuC----- Duncannon	4A	Slight	Slight	Slight	Moderate	Northern red oak----	80	62	250	0.80
						Black cherry-----	---	---	---	---
						Red maple-----	---	---	---	---
DuD----- Duncannon	4R	Moderate	Moderate	Slight	Moderate	Northern red oak----	80	62	250	0.80
						Black cherry-----	---	---	---	---
						Red maple-----	---	---	---	---
GaC----- Gallia	5A	Slight	Slight	Slight	Severe	White oak-----	85	67	285	0.90
						Northern red oak----	95	77	355	1.00
						Yellow-poplar-----	95	98	510	1.10
						Black walnut-----	---	---	---	---
						Black cherry-----	---	---	---	---
						Sugar maple-----	---	---	---	---
						White ash-----	---	---	---	---

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Average annual growth**		
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Cubic feet/ac	Board feet/ac	Cords feet/ac
GaD----- Gallia	5R	Moderate	Moderate	Slight	Severe	White oak-----	85	67	285	0.90
						Northern red oak----	95	77	355	1.00
						Yellow-poplar-----	95	98	510	1.10
						Black walnut-----	---	---	---	---
						Black cherry-----	---	---	---	---
						Sugar maple-----	---	---	---	---
						White ash-----	---	---	---	---
GpC*: Gilpin-----	4A	Slight	Slight	Slight	Moderate	Northern red oak----	80	62	250	0.80
						Yellow-poplar-----	90	90	440	1.00
						Sugar maple-----	---	---	---	---
						White oak-----	---	---	---	---
Upshur-----	3C	Severe	Severe	Slight	Severe	Northern red oak----	65	48	150	0.60
						Yellow-poplar-----	80	71	400	0.80
						Eastern white pine--	80	144	630	---
						Virginia pine-----	66	109	---	---
GpD*: Gilpin----- (North aspect)	4R	Moderate	Moderate	Slight	Moderate	Northern red oak----	80	62	125	0.60
						Yellow-poplar-----	90	90	440	1.00
						White oak-----	70	52	180	0.70
						Black oak-----	78	60	235	0.80
						Chestnut oak-----	70	52	180	0.70
Upshur----- (North aspect)	4C	Severe	Severe	Slight	Severe	Northern red oak----	74	56	210	0.75
						Yellow-poplar-----	82	75	410	0.90
						Eastern white pine--	80	144	630	---
						Virginia pine-----	70	109	---	---
GpD*: Gilpin----- (South aspect)	3R	Moderate	Moderate	Moderate	Moderate	Northern red oak----	66	48	150	0.60
						Yellow-poplar-----	90	90	440	1.00
						White oak-----	66	48	150	0.60
						Black oak-----	69	51	175	0.65
						Chestnut oak-----	69	51	175	0.65
						Scarlet oak-----	73	55	200	0.70
Upshur----- (South aspect)	3C	Severe	Severe	Slight	Moderate	Northern red oak----	60	43	110	0.50
						Eastern white pine--	75	132	565	---
						Virginia pine-----	63	---	---	---

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Average annual growth**		
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Cubic feet/ac	Board feet/ac	Cords feet/ac
GpE*: Gilpin----- (North aspect)	4R	Moderate	Moderate	Slight	Moderate	Northern red oak----	80	62	125	0.55
						Yellow-poplar-----	90	90	440	1.00
						White oak-----	70	52	180	0.70
						Black oak-----	78	60	235	0.80
						Chestnut oak-----	70	52	180	0.70
Upshur----- (North aspect)	4C	Severe	Severe	Slight	Severe	Northern red oak----	74	56	210	0.75
						Yellow-poplar-----	82	75	410	0.90
						Eastern white pine--	80	144	630	---
						Virginia pine-----	70	109	---	---
GpE*: Gilpin----- (South aspect)	3R	Moderate	Moderate	Moderate	Moderate	Northern red oak----	66	48	150	0.60
						Yellow-poplar-----	90	90	440	1.00
						White oak-----	66	48	150	0.60
						Black oak-----	69	51	175	0.65
						Chestnut oak-----	69	51	175	0.65
						Scarlet oak-----	73	55	200	0.50
Upshur----- (South aspect)	3C	Severe	Severe	Slight	Moderate	Northern red oak----	63	43	110	0.50
						Eastern white pine--	75	132	565	---
						Virginia pine-----	63	96	---	---
GpF*: Gilpin----- (North aspect)	4R	Severe	Severe	Slight	Moderate	Northern red oak----	80	62	125	0.55
						Yellow-poplar-----	90	90	440	1.00
						White oak-----	70	52	180	0.70
						Black oak-----	78	60	235	0.80
						Chestnut oak-----	70	52	180	0.70
Upshur----- (North aspect)	4R	Severe	Severe	Slight	Severe	Northern red oak----	74	56	210	0.75
						Yellow-poplar-----	82	75	410	0.90
						Eastern white pine--	80	144	630	---
						Virginia pine-----	70	109	---	---
GpF*: Gilpin----- (South aspect)	3R	Severe	Severe	Moderate	Moderate	Northern red oak----	66	48	150	0.60
						Yellow-poplar-----	90	90	440	1.00
						White oak-----	66	48	150	0.60
						Black oak-----	69	51	175	0.65
						Chestnut oak-----	69	51	175	0.65
						Scarlet oak-----	73	55	200	0.50
Upshur----- (South aspect)	3R	Severe	Severe	Slight	Moderate	Northern red oak----	60	43	110	0.50
						Eastern white pine--	75	132	565	---
						Virginia pine-----	63	96	---	---

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Average annual growth**		
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Cubic feet/ac	Board feet/ac	Cords feet/ac
GwC3*: Gilpin-----	4A	Slight	Slight	Slight	Moderate	Northern red oak----	80	62	250	0.80
						Yellow-poplar-----	90	90	440	1.00
						Virginia pine-----	67	104	---	---
Upshur-----	3C	Severe	Severe	Slight	Severe	Northern red oak----	65	48	150	0.60
						Yellow-poplar-----	80	71	400	0.80
						Eastern white pine--	80	144	630	---
						Virginia pine-----	66	109	---	---
GwD3*: Gilpin----- (North aspect)	4R	Moderate	Moderate	Slight	Moderate	Northern red oak----	80	62	250	0.80
						Yellow-poplar-----	90	90	440	1.00
						Virginia pine-----	67	104	---	---
Upshur----- (North aspect)	4C	Severe	Severe	Slight	Severe	Northern red oak----	74	56	210	0.75
						Yellow-poplar-----	82	75	410	0.90
						Eastern white pine--	80	144	630	---
						Virginia pine-----	70	109	---	---
GwD3*: Gilpin----- (South aspect)	3R	Moderate	Moderate	Moderate	Moderate	Northern red oak----	66	48	150	0.60
						Yellow-poplar-----	90	90	440	1.00
						White oak-----	66	48	150	0.60
						Black oak-----	69	51	175	0.65
						Chestnut oak-----	69	51	175	0.65
						Scarlet oak-----	73	55	200	0.50
Upshur----- (South aspect)	3C	Severe	Severe	Slight	Moderate	Northern red oak----	60	43	110	0.50
						Eastern white pine--	75	132	565	---
						Virginia pine-----	63	96	---	---
GwE3*: Gilpin----- (North aspect)	4R	Moderate	Moderate	Slight	Moderate	Northern red oak----	80	62	250	0.80
						Yellow-poplar-----	90	90	440	1.00
						Virginia pine-----	67	104	---	---
Upshur----- (North aspect)	4C	Severe	Severe	Slight	Severe	Northern red oak----	74	56	210	0.75
						Yellow-poplar-----	82	75	410	0.90
						Eastern white pine--	80	144	630	---
						Virginia pine-----	70	109	---	---

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Average annual growth**		
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Cubic feet/ac	Board feet/ac	Cords feet/ac
GwE3*: Gilpin----- (South aspect)	3R	Moderate	Moderate	Moderate	Moderate	Northern red oak----	66	48	150	0.60
						Yellow-poplar-----	90	90	440	1.00
						White oak-----	66	48	150	0.60
						Black oak-----	69	51	175	0.65
						Chestnut oak-----	69	51	175	0.65
						Scarlet oak-----	73	55	200	0.50
Upshur----- (South aspect)	3C	Severe	Severe	Slight	Moderate	Northern red oak----	60	43	110	0.50
						Eastern white pine--	75	132	565	---
						Virginia pine-----	63	96	---	---
GxF*: Gilpin----- (North aspect)	4R	Severe	Severe	Slight	Moderate	Northern red oak----	80	62	125	0.55
						Yellow-poplar-----	90	90	440	1.00
						White oak-----	70	52	180	0.70
						Black oak-----	78	60	235	0.80
						Chestnut oak-----	70	52	180	0.70
Upshur----- (North aspect)	4R	Severe	Severe	Slight	Severe	Northern red oak----	74	56	210	0.75
						Yellow-poplar-----	82	75	410	0.90
						Eastern white pine--	80	144	630	---
						Virginia pine-----	70	109	---	---
Rock outcrop. (North aspect)										
GxF*: Gilpin----- (South aspect)	3R	Severe	Severe	Moderate	Moderate	Northern red oak----	66	48	150	0.60
						Yellow-poplar-----	90	90	440	1.00
						White oak-----	66	48	150	0.60
						Black oak-----	69	51	175	0.65
						Chestnut oak-----	69	51	175	0.65
						Scarlet oak-----	73	55	200	0.50
Upshur-----	3R	Severe	Severe	Slight	Moderate	Northern red oak----	60	43	110	0.50
						Eastern white pine--	75	132	565	---
						Virginia pine-----	63	96	---	---
Rock outcrop. (South aspect)										

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Average annual growth**		
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Cubic feet/ac	Board feet/ac	Cords feet/ac
Gy----- Glenford	5A	Slight	Slight	Slight	Moderate	Northern red oak----	86	68	290	0.90
						Yellow-poplar-----	96	100	525	1.10
						White oak-----	---	---	---	---
						Black walnut-----	---	---	---	---
						Black cherry-----	---	---	---	---
						Sugar maple-----	---	---	---	---
						White ash-----	---	---	---	---
						American elm-----	---	---	---	---
HaA, HaB----- Hackers	5A	Slight	Slight	Slight	Severe	Northern red oak----	85	67	285	0.90
						Yellow-poplar-----	95	98	550	1.20
						White ash-----	85	111	---	---
						American Sycamore----	---	---	---	---
Hn----- Huntington	5A	Slight	Slight	Slight	-----	Northern red oak----	85	67	285	0.90
						Yellow-poplar-----	95	98	550	1.20
						Silver maple-----	---	---	---	---
						American sycamore----	---	---	---	---
						Boxelder-----	---	---	---	---
LaC----- Lakin	3S	Slight	Moderate	Severe	Moderate	Northern red oak----	60	43	110	0.50
						Black oak-----	60	43	110	0.50
						Yellow-poplar-----	---	---	---	---
						American sycamore----	---	---	---	---
						American beech-----	---	---	---	---
LkC----- Licking	4A	Slight	Slight	Slight	Moderate	White oak-----	75	57	215	0.70
						Northern red oak----	70	52	180	0.70
						Yellow-poplar-----	80	71	320	0.85
						Black cherry-----	---	---	---	---
						Sugar maple-----	---	---	---	---
						White ash-----	---	---	---	---
Ln----- Lindside	5A	Slight	Slight	Slight	Severe	Virginia pine-----	---	---	---	---
						Northern red oak----	86	68	290	0.90
						Yellow-poplar-----	95	98	550	1.20
						Black walnut-----	---	---	---	---
						White ash-----	85	111	---	---
						White oak-----	85	67	285	0.90
						Red maple-----	---	---	---	---

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Average annual growth**		
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Cubic feet/ac	Board feet/ac	Cords feet/ac
Me----- Melvin	5W	Slight	Moderate	Severe	Severe	Pin oak----- Willow-----	95 ---	77 ---	355 ---	1.00 ---
Mo----- Moshannon	5A	Slight	Slight	Slight	Moderate	Northern red oak---- Yellow-poplar----- Sugar maple----- Black walnut----- White oak----- White ash----- American sycamore---- American elm-----	85 95 85 --- --- --- --- ---	67 98 52 --- --- --- --- ---	285 510 --- --- --- --- --- ---	0.90 1.10 --- --- --- --- --- ---
OtA, OtB, OtC--- Otwell	3D	Slight	Slight	Moderate	Slight	White oak----- Yellow-poplar----- Virginia pine-----	65 --- ---	--- --- ---	--- --- ---	--- --- ---
Sn----- Sensabaugh	4A	Slight	Slight	Slight	Severe	White oak----- Yellow-poplar----- Black walnut----- American sycamore---- American elm-----	80 100 --- --- ---	48 107 --- --- ---	145 580 --- --- ---	0.60 1.25 --- --- ---
Ta----- Taggart	4A	Slight	Slight	Slight	Moderate	Northern red oak---- White oak----- Pin oak----- Yellow-poplar-----	75 75 85 85	57 57 67 81	215 215 285 420	0.70 0.70 0.90 0.90
UpC----- Upshur	3C	Severe	Severe	Slight	Severe	Northern red oak---- Yellow-poplar----- Eastern white pine-- Virginia pine-----	65 80 80 66	48 71 144 102	145 400 630 ---	0.60 0.80 --- ---
VaD----- Vandalia (North aspect)	4C	Moderate	Severe	Slight	Severe	Northern red oak---- Yellow-poplar----- Virginia pine----- American sycamore---- American beech----- American elm-----	74 100 72 --- --- ---	56 107 112 --- --- ---	210 580 --- --- --- ---	0.70 1.20 --- --- --- ---

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Average annual growth**		
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Cubic feet/ac	Board feet/ac	Cords feet/ac
VaD----- Vandalia (South aspect)	4C	Moderate	Severe	Moderate	Severe	Northern red oak----- Yellow-poplar----- Virginia pine----- American sycamore----- American beech----- American elm-----	71 100 72 --- --- ---	53 107 112 --- --- ---	185 580 --- --- --- ---	0.70 1.20 --- --- --- ---
VbD----- Vandalia (North aspect)	4C	Moderate	Severe	Slight	Severe	Northern red oak----- Yellow-poplar----- Virginia pine----- American sycamore----- American elm----- American beech-----	74 100 72 --- --- ---	56 107 112 --- --- ---	210 580 --- --- --- ---	0.70 1.20 --- --- --- ---
VbD----- Vandalia (South aspect)	4C	Moderate	Severe	Moderate	Severe	Northern red oak----- Yellow-poplar----- Virginia pine-----	71 100 72	53 107 112	185 580 ---	0.70 1.20 ---
WhA, WhB----- Wheeling	4A	Slight	Slight	Slight	Severe	Northern red oak----- Yellow-poplar-----	80 90	62 90	250 440	0.80 1.00
WnB**: Wheeling-----	4A	Slight	Slight	Slight	Severe	Northern red oak----- Yellow-poplar-----	80 90	62 90	250 440	0.80 1.00
Urban land. WoC----- Woodsfield	4C	Slight	Slight	Slight	Moderate	White oak----- Virginia pine----- Red maple----- Yellow-poplar-----	76 75 --- 80	58 115 --- 71	220 --- --- 400	0.75 --- --- 0.80

* See description of the map unit for composition and behavior characteristics of the map unit.

**Average annual growth is equal to total volume growth at rotation divided by rotation age. Actual annual growth varies with stand vigor and other factors. Yield data are based on site indices of natural stands at age 50 using the International 1/4 log rule and standard rough cords. This information should be used for planning only.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AsA----- Ashton	Severe: flooding.	Slight-----	Slight-----	Slight-----	Slight.
AsB----- Ashton	Severe: flooding.	Slight-----	Moderate: slope.	Slight-----	Slight.
CeE----- Cedarcreek	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
Cg----- Chagrin	Severe: flooding.	Slight-----	Moderate: flooding.	Slight-----	Moderate: flooding.
DuC----- Duncannon	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
DuD----- Duncannon	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
GaC----- Gallia	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
GaD----- Gallia	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
GpC*: Gilpin-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope, thin layer.
Upshur-----	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
GpD*: Gilpin-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Upshur-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
GpE*, GpF*: Gilpin-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Upshur-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
GwC3*: Gilpin-----	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope, thin layer.
Upshur-----	Severe: too clayey.	Severe: too clayey.	Severe: slope, too clayey.	Severe: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
GwD3*: Gilpin-----	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Upshur-----	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: too clayey.	Severe: slope, too clayey.
GwE3*: Gilpin-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Upshur-----	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: slope, too clayey.	Severe: slope, too clayey, erodes easily.	Severe: slope, too clayey.
GxF*: Gilpin-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Upshur-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Rock outcrop-----					
Gy----- Glenford	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Slight.
HaA----- Hackers	Severe: flooding.	Slight-----	Slight-----	Slight-----	Slight.
HaB----- Hackers	Severe: flooding.	Slight-----	Moderate: slope.	Slight-----	Slight.
Hn----- Huntington	Severe: flooding.	Slight-----	Moderate: flooding.	Slight-----	Moderate: flooding.
LaC----- Lakin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope, droughty.
LkC----- Licking	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Ln----- Lindside	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Moderate: wetness.	Moderate: flooding.
Me----- Melvin	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
Mo----- Moshannon	Severe: flooding.	Slight-----	Moderate: flooding.	Slight-----	Moderate: flooding.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
OtA----- Otwell	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight-----	Slight.
OtB----- Otwell	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Severe: erodes easily.	Slight.
OtC----- Otwell	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
Sn----- Sensabaugh	Severe: flooding.	Slight-----	Moderate: small stones.	Slight-----	Moderate: flooding.
Ta----- Taggart	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
UpC----- Upshur	Moderate: slope, percs slowly.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
VaD----- Vandalia	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
VbD----- Vandalia	Severe: slope.	Severe: slope.	Severe: large stones, slope.	Severe: erodes easily.	Severe: slope.
WhA----- Wheeling	Slight-----	Slight-----	Slight-----	Slight-----	Slight.
WhB----- Wheeling	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
WnB*: Wheeling-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
Urban land-----					
WoC----- Woodsfield	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AsA----- Ashton	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
AsB----- Ashton	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CeE----- Cedarcreek	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Cg----- Chagrin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
DuC----- Duncannon	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
DuD----- Duncannon	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
GaC----- Gallia	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
GaD----- Gallia	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
GpC*: Gilpin-----	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.
Upshur-----	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
GpD*: Gilpin-----	Poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Upshur-----	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
GpE*: Gilpin-----	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Upshur-----	Very poor.	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
GpF*: Gilpin-----	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Upshur-----	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
GwC3*: Gilpin-----	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
GwC3*: Upshur-----	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
GwD3*: Gilpin-----	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Upshur-----	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
GwE3*: Gilpin-----	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Upshur-----	Very poor.	Fair	Fair	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
GxF*: Gilpin-----	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Upshur-----	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Rock outcrop.										
Gy----- Glenford	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
HaA----- Hackers	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
HaB----- Hackers	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Hn----- Huntington	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LaC----- Lakin	Poor	Fair	Fair	Poor	Poor	Very poor.	Very poor.	Fair	Poor	Very poor.
LkC----- Licking	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ln----- Lindside	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Me----- Melvin	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Mo----- Moshannon	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OtA, OtB----- Otwell	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
OtC----- Otwell	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
Sn----- Sensabaugh	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Ta----- Taggart	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
UpC----- Upshur	Fair	Good	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
VaD----- Vandalia	Poor	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
VbD----- Vandalia	Very poor.	Poor	Fair	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
WhA----- Wheeling	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WhB----- Wheeling	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WnB*: Wheeling----- Urban land.	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WoC----- Woodsfield	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AsA, AsB----- Ashton	Slight-----	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, frost action.	Slight.
CeE----- Cedarcreek	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Cg----- Chagrin	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
DuC----- Duncannon	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
DuD----- Duncannon	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
GaC----- Gallia	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: low strength, slope, frost action.	Moderate: slope.
GaD----- Gallia	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
GpC*: Gilpin-----	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer.
Upshur-----	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell, slippage.	Severe: shrink-swell, low strength.	Moderate: slope.
GpD*, GpE*, GpF*: Gilpin-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Upshur-----	Severe: slope, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, low strength.	Severe: slope.
GwC3*: Gilpin-----	Moderate: slope, depth to rock.	Moderate: slope.	Moderate: slope, depth to rock.	Severe: slope.	Moderate: slope, frost action.	Moderate: slope, thin layer.
Upshur-----	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell, slippage.	Severe: shrink-swell, low strength.	Severe: too clayey.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
GwD3*, GwE3*: Gilpin-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Upshur-----	Severe: slope, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, low strength.	Severe: slope, too clayey.
GxF*: Gilpin-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Upshur-----	Severe: slope, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, slippage.	Severe: slope, shrink-swell, low strength.	Severe: slope.
Rock outcrop----						
Gy----- Glenford	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
HaA, HaB----- Hackers	Slight-----	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding, frost action.	Slight.
Hn----- Huntington	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
LaC----- Lakin	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope, droughty.
LkC----- Licking	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, frost action.	Moderate: slope.
Ln----- Lindside	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Me----- Melvin	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
Mo----- Moshannon	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Moderate: flooding.
OtA----- Otwell	Moderate: wetness.	Moderate: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
OtB----- Otwell	Moderate: wetness, too clayey.	Moderate: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.
OtC----- Otwell	Moderate: wetness, too clayey, slope.	Moderate: wetness, shrink-swell, slope.	Moderate: wetness, slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Sn----- Sensabaugh	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
Ta----- Taggart	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
UpC----- Upshur	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell, slippage.	Severe: shrink-swell, low strength.	Moderate: slope.
VaD, VbD----- Vandalia	Severe: slope, slippage.	Severe: shrink-swell, slope, slippage.	Severe: slope, shrink-swell, slippage.	Severe: shrink-swell, slope, slippage.	Severe: low strength, slope, shrink-swell.	Severe: slope.
WhA----- Wheeling	Slight-----	Slight-----	Slight-----	Slight-----	Moderate: frost action, low strength.	Slight.
WhB----- Wheeling	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action, low strength.	Slight.
WnB*: Wheeling-----	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action, low strength.	Slight.
Urban land-----						
WoC----- Woodsfield	Moderate: too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AsA, AsB----- Ashton	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: flooding.	Fair: too clayey.
CeE----- Cedarcreek	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
Cg----- Chagrin	Severe: flooding.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Good.
DuC----- Duncannon	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: area reclaim, slope.
DuD----- Duncannon	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
GaC----- Gallia	Moderate: slope.	Severe: slope.	Severe: seepage.	Moderate: slope.	Fair: too clayey, small stones, slope.
GaD----- Gallia	Severe: slope.	Severe: slope.	Severe: slope, seepage.	Severe: slope.	Poor: slope.
GpC*: Gilpin-----	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Upshur-----	Severe: percs slowly.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
GpD*, GpE*, GpF*: Gilpin-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
Upshur-----	Severe: slope, percs slowly, slippage.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope, slippage.	Poor: slope, too clayey, hard to pack.
GwC3*: Gilpin-----	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, thin layer.
Upshur-----	Severe: percs slowly.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
GwD3*, GwE3*: Gilpin-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
Upshur-----	Severe: slope, percs slowly, slippage.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope, slippage.	Poor: slope, too clayey, hard to pack.
GxF*: Gilpin-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
Upshur-----	Severe: slope, percs slowly, slippage.	Severe: slope.	Severe: slope, too clayey, depth to rock.	Severe: slope, slippage.	Poor: slope, too clayey, hard to pack.
Rock outcrop-----					
Gy----- Glenford	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
HaA, HaB----- Hackers	Moderate: flooding.	Severe: flooding.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.
Hn----- Huntington	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
LaC----- Lakin	Severe: poor filter.	Severe: slope, seepage.	Severe: slope, seepage.	Severe: seepage.	Poor: seepage.
LkC----- Licking	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Moderate: slope, wetness.	Poor: too clayey, hard to pack.
Ln----- Lindside	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.
Me----- Melvin	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
Mo----- Moshannon	Severe: flooding.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Fair: too clayey.
OtA----- Otwell	Severe: wetness, percs slowly.	Slight-----	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness, thin layer.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
OtB----- Otwell	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness, thin layer.
OtC----- Otwell	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Fair: too clayey, slope, wetness, thin layer.
Sn----- Sensabaugh	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Poor: small stones.
Ta----- Taggart	Severe: wetness, percs slowly.	Severe: wetness, seepage.	Severe: seepage, wetness.	Severe: wetness.	Poor: wetness.
UpC----- Upshur	Severe: percs slowly.	Severe: slope.	Severe: too clayey, depth to rock.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.
VaD, VbD----- Vandalia	Severe: slope, percs slowly, slippage.	Severe: slope.	Severe: slope, too clayey, slippage.	Severe: slope, slippage.	Poor: too clayey, hard to pack, slope.
WhA, WhB----- Wheeling	Moderate: percs slowly.	Moderate: seepage.	Slight-----	Slight-----	Fair: thin layer.
WnB*: Wheeling-----	Moderate: percs slowly.	Moderate: seepage.	Slight-----	Slight-----	Fair: thin layer.
Urban land-----					
WoC----- Woodsfield	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Poor: too clayey, hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AsA, AsB----- Ashton	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
CeE----- Cedarcreek	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Cg----- Chagrin	Good-----	Improbable: excess fines.	Improbable: excess fines.	Good.
DuC----- Duncannon	Fair: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
DuD----- Duncannon	Fair: area reclaim, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
GaC----- Gallia	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
GaD----- Gallia	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
GpC*: Gilpin-----	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
Upshur-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
GpD*: Gilpin-----	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Upshur-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
GpE*, GpF*: Gilpin-----	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Upshur-----	Poor: slope, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
GwC3*: Gilpin-----	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
GwC3*: Upshur-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
GwD3*: Gilpin-----	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Upshur-----	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
GwE3*: Gilpin-----	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Upshur-----	Poor: slope, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
GxF*: Gilpin-----	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Upshur-----	Poor: slope, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey.
Rock outcrop-----				
Gy----- Glenford	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
HaA, HaB----- Hackers	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Hn----- Huntington	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
LaC----- Lakin	Good-----	Probable-----	Improbable: excess fines.	Fair: too sandy, slope.
LkC----- Licking	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer, slope.
Ln----- Lindside	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Me----- Melvin	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Mo----- Moshannon	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
OtA, OtB----- Otwell	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
OtC----- Otwell	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Sn----- Sensabaugh	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
Ta----- Taggart	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
UpC----- Upshur	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
VaD, VbD----- Vandalia	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, thin layer.
WhA, WhB----- Wheeling	Fair: low strength.	Probable-----	Probable-----	Fair: small stones.
WnB*: Wheeling-----	Fair: low strength.	Probable-----	Probable-----	Fair: small stones.
Urban land-----				
WoC----- Woodsfield	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
AsA, AsB----- Ashton	Moderate: seepage.	Severe: piping.	Deep to water----	Erodes easily----	Erodes easily.
CeE----- Cedar creek	Severe: seepage, slope.	Moderate: large stones.	Deep to water----	Slope, large stones.	Large stones, slope, droughty.
Cg----- Chagrin	Moderate: seepage.	Severe: piping.	Deep to water----	Favorable-----	Favorable.
DuC, DuD----- Duncannon	Severe: slope.	Severe: piping.	Deep to water----	Slope, erodes easily.	Slope, erodes easily.
GaC, GaD----- Gallia	Severe: slope.	Moderate: piping.	Deep to water----	Slope, erodes easily.	Slope, erodes easily.
GpC*, GpD*, GpE*, GpF*, GwC3*, GwD3*, GwE3*: Gilpin-----	Severe: slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
Upshur-----	Severe: slope, slippage.	Severe: hard to pack.	Deep to water----	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
GxF*: Gilpin-----	Severe: slope.	Severe: thin layer.	Deep to water----	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
Upshur-----	Severe: slope, slippage.	Severe: hard to pack.	Deep to water----	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
Rock outcrop----					
Gy----- Glenford	Moderate: seepage.	Severe: piping.	Frost action----	Erodes easily, wetness.	Erodes easily.
HaA----- Hackers	Moderate: seepage.	Severe: piping.	Deep to water----	Favorable-----	Favorable.
HaB----- Hackers	Moderate: seepage, slope.	Severe: piping.	Deep to water----	Favorable-----	Favorable.
Hn----- Huntington	Moderate: seepage.	Severe: piping.	Deep to water----	Favorable-----	Favorable.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
LaC----- Lakin	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water----	Slope, too sandy.	Slope, droughty.
LkC----- Licking	Severe: slope.	Severe: hard to pack.	Slope, percs slowly, frost action.	Slope, wetness, erodes easily.	Slope, erodes easily, percs slowly.
Ln----- Lindside	Moderate: seepage.	Severe: piping.	Flooding, frost action.	Wetness, erodes easily.	Erodes easily.
Me----- Melvin	Moderate: seepage.	Severe: piping, wetness.	Flooding-----	Erodes easily, wetness.	Wetness, erodes easily.
Mo----- Moshannon	Moderate: seepage.	Severe: piping.	Deep to water----	Erodes easily----	Erodes easily.
OtA----- Otwell	Slight-----	Moderate: thin layer, wetness.	Percs slowly, frost action.	Erodes easily, wetness.	Erodes easily, rooting depth.
OtB----- Otwell	Moderate: slope.	Moderate: thin layer, wetness.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
OtC----- Otwell	Severe: slope.	Moderate: thin layer, wetness.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
Sn----- Sensabaugh	Severe: seepage.	Moderate: large stones.	Deep to water----	Large stones----	Large stones.
Ta----- Taggart	Moderate: seepage.	Severe: wetness.	Percs slowly, frost action.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
UpC----- Upshur	Severe: slope, slippage.	Severe: hard to pack.	Deep to water----	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.
VaD, VbD----- Vandalia	Severe: slope, slippage.	Moderate: hard to pack.	Deep to water----	Slope, erodes easily.	Slope, erodes easily, percs slowly.
WhA----- Wheeling	Moderate: seepage.	Severe: piping.	Deep to water----	Favorable-----	Favorable.
WhB----- Wheeling	Moderate: seepage, slope.	Severe: piping.	Deep to water----	Favorable-----	Favorable.
WnB*: Wheeling-----	Moderate: seepage, slope.	Severe: piping.	Deep to water----	Favorable-----	Favorable.
Urban land-----					

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
WoC----- Woodsfield	Severe: slope.	Severe: hard to pack.	Deep to water----	Slope, erodes easily, percs slowly.	Slope, erodes easily, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
AsA, AsB----- Ashton	0-10	Silt loam-----	ML	A-4	0	95-100	90-100	75-100	60-95	<35	NP-10
	10-55	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	95-100	90-100	85-100	80-100	25-42	5-20
	55-65	Silt loam, loam, fine sandy loam.	ML, CL, SM, CL-ML	A-4, A-6	0-5	90-100	85-100	65-95	40-90	<40	NP-20
CeE----- Cedarcreek	0-8	Channery silt loam.	GC	A-2, A-4	15-30	45-60	40-55	30-50	20-40	25-35	7-12
	8-65	Channery loam, very channery silt loam, very channery sandy loam.	GC	A-2, A-4	5-30	45-60	40-55	35-50	25-45	25-35	7-12
Cg----- Chagrin	0-11	Loam-----	ML, CL, CL-ML	A-4	0	95-100	85-100	80-100	70-90	20-35	2-10
	11-65	Silt loam, loam, sandy loam.	ML, SM	A-4, A-2, A-6	0	90-100	75-100	55-90	30-80	20-40	NP-14
DuC, DuD----- Duncannon	0-6	Silt loam-----	ML	A-4	0	95-100	90-100	85-100	70-100	20-30	NP-5
	6-65	Silt loam, fine sandy loam.	ML, CL, CL-ML	A-4	0	95-100	90-100	85-100	70-100	17-30	NP-8
GaC, GaD----- Gallia	0-13	Silt loam-----	ML, CL, CL-ML	A-4	0	100	85-100	75-95	60-85	22-35	3-10
	13-65	Sandy clay loam, clay loam.	CL, SC	A-6	0	85-100	65-100	60-95	35-70	32-40	13-20
GpC*, GpD*, GpE*, GpF*:----- Gilpin	0-7	Silt loam-----	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	7-19	Silt loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	19-30	Silt loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Upshur-----	0-3	Silty clay loam	CL, ML	A-6, A-7	0	95-100	95-100	90-100	80-95	35-50	11-25
	3-44	Silty clay, clay	MH, CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	20-40
	44	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
GwC3*, GwD3*, GwE3*: Gilpin-----	In										
	0-7	Silt loam-----	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	7-19	Silt loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	19-30	Silt loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Upshur-----	0-3	Silty clay-----	MH, ML, CL	A-7	0	95-100	95-100	90-100	80-100	35-60	15-30
	3-44	Silty clay, clay	MH, CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	20-40
	44	Weathered bedrock	---	---	---	---	---	---	---	---	---
GxF*: Gilpin-----	0-7	Silt loam-----	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	7-19	Silt loam, shaly silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	19-30	Silt loam, very channery silt loam, very shaly silty clay loam.	GC, GM-GC	A-1, A-2, A-4, A-6	0-35	25-55	20-50	15-45	15-40	20-40	4-15
	30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Upshur-----	0-3	Silty clay loam	CL, ML	A-6, A-7	0	95-100	95-100	90-100	80-95	35-50	11-25
	3-44	Silty clay, clay	MH, CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	20-40
	44	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop----											
Gy----- Glenford	0-7	Silt loam-----	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-100	25-38	4-14
	7-55	Silty clay loam, silt loam.	CL, CL-ML, ML	A-6, A-7, A-4	0	100	100	95-100	80-100	25-45	5-18
	55-65	Stratified silty clay loam to fine sandy loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	70-100	20-40	3-15
HaA, HaB----- Hackers	0-8	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0	90-100	90-100	75-100	60-90	20-35	3-12
	8-44	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	90-100	90-100	90-100	75-95	25-40	4-18
	44-65	Fine sandy loam, silt loam, loam.	ML, CL, SM, SC	A-4, A-6	0	85-100	60-100	55-95	40-85	20-40	1-15
Hn----- Huntington	0-14	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	14-58	Silt loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	60-95	25-40	5-15
	58-65	Stratified fine sand to silty clay loam.	SM, SC, ML, CL	A-2, A-4	0-10	95-100	60-100	50-90	30-75	30	NP-10

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
LaC----- Lakin	0-21	Loamy fine sand	SM, SM-SC	A-2	0	95-100	95-100	95-100	10-35	<30	NP-7
	21-65	Loamy sand, fine sand, loamy fine sand.	SM, SM-SC, SP-SM	A-2, A-3	0	95-100	95-100	90-100	5-35	<30	NP-7
LkC----- Licking	0-8	Silt loam-----	ML, CL-ML, CL	A-4	0	95-100	95-100	90-100	70-90	22-35	4-10
	8-20	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	90-100	80-95	30-50	15-25
	20-54	Silty clay loam, silty clay, clay	CH, CL	A-7	0	100	100	95-100	75-95	45-70	26-42
	54-65	Clay, silty clay.	CH, CL, ML, MH	A-7	0	100	100	90-100	70-95	45-70	20-36
Ln----- Lindside	0-11	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-90	20-35	2-15
	11-45	Silty clay loam, silt loam.	CL, ML, CL-ML	A-4, A-6	0	100	95-100	90-100	70-95	25-40	4-18
	45-65	Stratified silty clay loam to gravelly sandy loam.	CL, ML, SM, SC	A-2, A-4, A-6	0	60-100	55-100	45-100	30-95	20-40	4-18
Me----- Melvin	0-9	Silt loam-----	CL, CL-ML, ML	A-4	0	95-100	90-100	80-100	80-95	25-35	4-10
	9-36	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	80-95	25-40	5-20
	36-65	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	85-100	80-100	70-100	60-95	25-40	5-20
Mo----- Moshannon	0-6	Silt loam-----	ML, CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	70-95	22-40	3-15
	6-38	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	90-100	80-95	25-40	3-15
	38-65	Silt loam, loam, fine sandy loam.	ML, CL, CL-ML, SC	A-4, A-6	0	80-100	70-100	55-100	35-80	25-40	3-15
OtA, OtB, OtC---- Otwell	0-9	Silt loam-----	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-35	5-15
	9-27	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-95	25-40	5-20
	27-65	Silty clay loam, loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	85-100	65-90	35-50	20-30
Sn----- Sensabaugh	0-8	Silt loam-----	CL-ML, CL, ML	A-4	0-5	90-100	75-95	65-85	55-75	16-29	3-9
	8-33	Silt loam, very gravelly clay loam, very gravelly silt loam.	CL-ML, CL, SM-SC, GC	A-4, A-6	2-18	70-95	55-90	45-75	35-65	20-35	5-14
	33-65	Gravelly silt loam, gravelly clay loam, very gravelly clay loam.	SM-SC, SC, GM-GC, GC	A-4, A-6, A-2	5-30	55-90	25-75	25-65	20-55	20-36	6-15

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches Pct	Percentage passing sieve number--				Liquid limit Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
Ta----- Taggart	0-11	Silt loam-----	CL, CL-ML	A-4	0	100	100	90-100	70-90	20-30	5-10
	11-65	Silty clay loam, clay loam, silt loam.	CL	A-6	0	100	100	95-100	85-95	30-40	10-20
UpC----- Upshur	0-3	Silty clay loam	CL, ML	A-6, A-7	0	95-100	95-100	90-100	80-95	35-50	11-25
	3-44	Silty clay, clay	MH, CH, CL	A-7	0	95-100	95-100	90-100	85-100	45-70	20-40
	44	Weathered bedrock	---	---	---	---	---	---	---	---	---
VaD----- Vandalia	0-6	Silt loam-----	ML, CL	A-4, A-6, A-7	0-5	80-100	75-100	70-95	50-90	25-45	5-20
	6-45	Channery silty clay loam, channery silty clay, clay.	CL, CH, ML	A-6, A-7	0-5	75-100	70-95	65-90	60-85	35-55	15-30
	45-65	Silty clay, clay, channery silty clay loam.	CL, CH, ML, MH	A-6, A-7	0-5	70-100	65-100	60-100	55-100	30-55	10-30
VbD----- Vandalia	0-6	Silt loam-----	ML, CL	A-4, A-6, A-7	15-30	65-95	60-80	55-75	55-65	25-45	5-20
	6-45	Silty clay loam, clay loam, silty clay.	MH, CL, CH, ML	A-6, A-7	0-5	70-100	70-95	65-90	60-85	35-55	15-30
	45-65	Silty clay, clay, silty clay loam.	MH, CH, CL, ML	A-6, A-7	0-5	70-100	65-100	60-100	55-100	30-55	10-30
WhA, WhB----- Wheeling	0-10	Silt loam-----	ML, CL, SM, SC	A-4	0	90-100	90-100	85-100	45-90	15-35	NP-10
	10-65	Silt loam, loam, sandy loam.	ML, CL, SM, SC	A-4, A-6	0-5	90-100	70-100	65-100	45-80	20-40	2-20
WnB*: Wheeling-----	0-10	Silt loam-----	ML, CL, SM, SC	A-4	0	90-100	90-100	85-100	45-90	15-35	NP-10
	10-65	Silt loam, loam, loam, sandy loam.	ML, CL, SM, SC	A-4, A-6	0-5	90-100	70-100	65-100	45-80	20-40	2-20
Urban land-----											
WoC----- Woodsfield	0-7	Silt loam-----	CL, CL-ML, ML	A-4, A-6	0	95-100	90-100	85-100	65-90	25-40	5-15
	7-20	Silt loam, silty clay loam.	CL	A-6, A-7	0	95-100	90-100	85-100	65-90	30-50	10-25
	20-50	Silty clay loam, silty clay, clay.	CH, CL, MH, ML	A-7, A-6	0-5	85-100	75-100	70-100	60-95	35-75	15-40
	50-65	Silty clay loam, clay, silty clay.	CH, CL, MH, ML	A-6, A-7	0-5	85-100	75-100	70-100	60-95	35-65	15-30

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
AsA, AsB----- Ashton	0-10	10-25	1.20-1.40	0.6-2.0	0.16-0.23	5.6-7.3	Low-----	0.32	5	2-4
	10-55	18-34	1.20-1.50	0.6-2.0	0.18-0.23	5.6-7.3	Low-----	0.43		
	55-65	10-40	1.25-1.55	0.6-2.0	0.14-0.20	5.6-7.3	Low-----	0.43		
CeE----- Cedarcreek	0-8	18-27	1.35-1.65	0.6-2.0	0.07-0.16	3.6-5.5	Low-----	0.32	5	<.5
	8-65	18-27	1.35-1.65	0.6-2.0	0.07-0.16	3.6-5.5	Low-----	0.32		
Cg----- Chagrin	0-11	10-27	1.20-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low-----	0.32	5	2-4
	11-65	18-30	1.20-1.50	0.6-2.0	0.14-0.20	5.6-7.3	Low-----	0.32		
DuC, DuD----- Duncannon	0-6	10-20	1.20-1.40	0.6-2.0	0.16-0.20	5.1-6.0	Low-----	0.37	4	2-4
	6-65	10-24	1.40-1.60	0.6-2.0	0.14-0.16	5.1-6.5	Low-----	0.43		
GaC, GaD----- Gallia	0-13	10-22	1.30-1.50	0.6-2.0	0.18-0.23	4.5-5.5	Low-----	0.37	5	1-3
	13-65	18-35	1.20-1.60	0.6-2.0	0.12-0.18	4.5-5.5	Moderate-----	0.37		
GpC*, GpD*, GpE*, GpF*: Gilpin-----	0-7	15-27	1.20-1.40	0.6-2.0	0.12-0.18	4.5-5.5	Low-----	0.32	3	.5-4
	7-19	18-35	1.20-1.50	0.6-2.0	0.12-0.16	4.5-5.5	Low-----	0.24		
	19-30	15-35	1.20-1.50	0.6-2.0	0.08-0.12	4.5-5.5	Low-----	0.24		
	30	---	---	---	---	---	---	---		
Upshur-----	0-3	27-35	1.20-1.50	0.2-0.6	0.12-0.16	4.5-6.5	Moderate-----	0.37	3	.5-3
	3-44	40-55	1.30-1.60	0.06-0.2	0.10-0.14	4.5-6.5	High-----	0.32		
	44	---	---	---	---	---	---	---		
GwC3*, GwD3*, GwE3*: Gilpin-----	0-7	15-27	1.20-1.40	0.6-2.0	0.12-0.18	4.5-5.5	Low-----	0.32	3	.5-4
	7-19	18-35	1.20-1.50	0.6-2.0	0.12-0.16	4.5-5.5	Low-----	0.24		
	19-30	15-35	1.20-1.50	0.6-2.0	0.08-0.12	4.5-5.5	Low-----	0.24		
	30	---	---	---	---	---	---	---		
Upshur-----	0-3	40-50	1.30-1.50	0.2-0.6	0.12-0.16	4.5-6.5	High-----	0.32	2	.5-2
	3-44	40-55	1.30-1.60	0.06-0.2	0.10-0.14	4.5-6.5	High-----	0.32		
	44	---	---	---	---	---	---	---		
GxF*: Gilpin-----	0-7	15-27	1.20-1.40	0.6-2.0	0.12-0.18	4.5-5.5	Low-----	0.32	3	.5-4
	7-19	18-35	1.20-1.50	0.6-2.0	0.12-0.16	4.5-5.5	Low-----	0.24		
	19-30	15-35	1.20-1.50	0.6-2.0	0.08-0.12	4.5-5.5	Low-----	0.24		
	30	---	---	---	---	---	---	---		
Upshur-----	0-3	27-35	1.20-1.50	0.2-0.6	0.12-0.16	4.5-6.5	Moderate-----	0.37	3	.5-3
	3-44	40-55	1.30-1.60	0.06-0.2	0.10-0.14	4.5-6.5	High-----	0.32		
	44	---	---	---	---	---	---	---		
Gy----- Glenford	0-7	16-27	1.30-1.45	0.6-2.0	0.16-0.20	5.1-6.0	Low-----	0.37	5-4	1-3
	7-55	18-35	1.45-1.68	0.2-0.6	0.14-0.18	5.1-7.3	Moderate-----	0.37		
	55-65	16-30	1.40-1.60	0.2-2.0	0.12-0.17	5.6-7.3	Low-----	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cc	In/hr	In/in	pH				Pct
HaA, HaB----- Hackers	0-8 8-44 44-65	15-27 18-35 18-35	1.20-1.40 1.30-1.50 1.30-1.50	0.6-2.0 0.6-2.0 0.6-2.0	0.18-0.24 0.12-0.18 0.12-0.18	5.1-6.0 5.1-6.0 5.1-6.0	Low----- Moderate----- Low-----	0.32 0.37 0.28	4	2-4
Hn----- Huntington	0-14 14-58 58-65	18-30 18-30 15-30	1.10-1.30 1.30-1.50 1.30-1.50	0.6-2.0 0.6-2.0 0.6-2.0	0.18-0.24 0.16-0.22 0.10-0.16	6.1-7.3 6.1-7.3 6.1-7.3	Low----- Low----- Low-----	0.28 0.32 0.28	5	3-6
LaC----- Lakin	0-21 21-65	2-6 3-8	1.20-1.40 1.30-1.50	6.0-20 6.0-20	0.06-0.10 0.04-0.08	5.1-6.0 5.1-6.0	Low----- Low-----	0.17 0.17	5	1-2
LkC----- Licking	0-8 8-20 20-54 54-65	15-27 24-35 40-60 40-60	1.35-1.50 1.40-1.60 1.45-1.65 1.55-1.75	0.6-2.0 0.2-0.6 0.06-0.2 0.06-0.2	0.14-0.18 0.12-0.16 0.10-0.14 0.10-0.16	4.5-6.0 4.5-6.0 6.1-7.3 6.1-7.3	Low----- Moderate----- High----- High-----	0.43 0.43 0.32 0.32	3	2-3
Ln----- Lindside	0-11 11-45 45-65	15-27 18-35 18-35	1.20-1.40 1.20-1.40 1.20-1.40	0.6-2.0 0.6-2.0 0.2-6.0	0.20-0.26 0.17-0.22 0.12-0.18	5.6-7.3 5.6-7.3 5.6-7.3	Low----- Low----- Low-----	0.32 0.37 0.32	5	2-4
Me----- Melvin	0-9 9-36 36-65	12-17 12-35 7-35	1.20-1.60 1.30-1.60 1.40-1.70	0.6-2.0 0.6-2.0 0.6-2.0	0.18-0.23 0.18-0.23 0.16-0.23	6.1-7.3 6.1-7.3 6.1-7.3	Low----- Low----- Low-----	0.43 0.43 0.43	5	.5-3
Mo----- Moshannon	0-6 6-38 38-65	15-32 18-32 12-32	1.20-1.50 1.20-1.50 1.20-1.50	0.6-2.0 0.6-2.0 0.6-2.0	0.20-0.24 0.18-0.22 0.14-0.18	5.6-6.5 5.6-6.5 5.6-6.5	Low----- Low----- Low-----	0.37 0.37 0.37	5	1-3
OtA, OtB, OtC---- Otwell	0-9 9-27 27-65	18-27 22-35 18-30	1.25-1.40 1.30-1.45 1.60-1.80	0.6-2.0 0.06-0.2 <0.06	0.22-0.24 0.18-0.22 0.06-0.08	4.5-6.0 4.5-6.0 4.5-6.0	Low----- Low----- Moderate-----	0.43 0.43 0.43	3	.5-2
Sn----- Sensabaugh	0-8 8-33 33-65	8-25 18-35 12-38	1.25-1.40 1.30-1.50 1.25-1.50	0.6-6.0 0.6-6.0 0.6-6.0	0.12-0.18 0.10-0.16 0.08-0.14	5.6-7.3 5.6-7.3 5.6-7.3	Low----- Low----- Low-----	0.24 0.20 0.17	5	1-3
Ta----- Taggart	0-11 11-65	12-20 25-35	1.30-1.45 1.40-1.60	0.6-2.0 0.06-0.2	0.22-0.24 0.18-0.20	4.5-6.0 4.5-6.5	Low----- Moderate-----	0.37 0.37	5	1-3
UpC----- Upshur	0-3 3-44 44	27-35 40-55 ---	1.20-1.50 1.30-1.60 ---	0.2-0.6 0.06-0.2 ---	0.12-0.16 0.10-0.14 ---	4.5-6.5 4.5-6.5 ---	Moderate----- High----- ---	0.37 0.32 ---	3	.5-3
VaD----- Vandalia	0-6 6-45 45-65	20-35 35-50 27-50	1.20-1.50 1.30-1.60 1.30-1.60	0.2-2.0 0.06-0.2 0.06-0.6	0.12-0.18 0.12-0.15 0.08-0.12	5.1-6.0 5.1-7.3 5.1-7.3	Moderate----- High----- High-----	0.37 0.32 0.32	4	1-3
VbD----- Vandalia	0-6 6-45 45-65	20-35 35-50 27-50	1.20-1.50 1.30-1.60 1.30-1.60	0.2-2.0 0.06-0.2 0.06-0.6	0.12-0.18 0.12-0.15 0.08-0.12	5.1-6.0 5.1-7.3 5.1-7.3	Moderate----- High----- High-----	0.32 0.32 0.32	4	---
WhA, WhB----- Wheeling	0-10 10-65	12-20 18-30	1.20-1.40 1.30-1.50	0.6-2.0 0.6-2.0	0.12-0.18 0.08-0.16	5.6-6.0 5.6-6.0	Low----- Low-----	0.37 0.32	4	1-3
WnB*: Wheeling-----	0-10 10-65	12-20 18-30	1.20-1.40 1.30-1.50	0.6-2.0 0.6-2.0	0.12-0.18 0.08-0.16	5.6-6.0 5.6-6.0	Low----- Low-----	0.37 0.32	4	1-3

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	<u>In</u>	<u>Pct</u>	<u>G/cc</u>	<u>In/hr</u>	<u>In/in</u>	<u>pH</u>				<u>Pct</u>
WnB*: Urban land-----										
WoC-----	0-7	15-27	1.35-1.50	0.6-2.0	0.17-0.21	4.5-5.5	Low-----	0.43	3	1-3
Woodsfield	7-20	22-35	1.40-1.60	0.6-2.0	0.15-0.19	4.5-5.5	Moderate----	0.32		
	20-50	35-60	1.40-1.70	0.06-0.2	0.12-0.16	5.1-7.3	High-----	0.32		
	50-65	35-60	1.40-1.70	0.06-0.6	0.07-0.14	5.6-7.8	Moderate----	0.32		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding	High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Depth Ft	Kind	Months	Depth In	Hardness		Uncoated steel	Concrete
AsA, AsB----- Ashton	B	Rare-----	>6.0	---	---	>60	---	High-----	Low-----	Low.
CeE----- Cedarcreek	C	None-----	>6.0	---	---	>60	---	Moderate	Moderate	High.
Cg----- Chagrin	B	Occasional-----	4.0-6.0	Apparent	Feb-Mar	>60	---	Moderate	Low-----	Moderate.
DuC, DuD----- Duncannon	B	None-----	>6.0	---	---	>60	---	High-----	Low-----	Moderate.
GaC, GaD----- Gallia	B	None-----	>6.0	---	---	>60	---	Moderate	Low-----	High.
GpC*, GpD*, GpE*, GpF*, GwC3*, GwD3*, GwE3*: Gilpin-----	C	None-----	>6.0	---	---	20-40	Hard-----	Moderate	Low-----	High.
Upshur-----	D	None-----	>6.0	---	---	40-60	Soft	Moderate	High-----	Moderate.
GxF*: Gilpin-----	C	None-----	>6.0	---	---	20-40	Hard-----	Moderate	Low-----	High.
Upshur-----	D	None-----	>6.0	---	---	40-60	Soft	Moderate	High-----	Moderate.
Rock outcrop----										
Gy----- Glenford	C	None-----	2.0-3.5	Perched	Nov-May	>60	---	High-----	Moderate	Moderate.
HaA, HaB----- Hackers	B	Rare-----	>6.0	---	---	>60	---	Moderate	Low-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding	High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Depth <u>Ft</u>	Kind	Months	Depth <u>In</u>	Hardness		Uncoated steel	Concrete
Hn----- Huntington	B	Occasional-----	>6.0	---	---	60	---	High-----	Low-----	Moderate.
LaC----- Lakin	A	None-----	>6.0	---	---	>60	---	Low-----	Low-----	High.
LkC----- Licking	C	None-----	2.0-3.5	Perched	Jan-Apr	>60	---	High-----	High-----	High.
Ln----- Lindside	C	Occasional-----	1.5-3.0	Apparent	Dec-Apr	>60	---	High-----	Moderate	Low.
Me----- Melvin	D	Occasional-----	0-1.0	Apparent	Dec-May	>60	---	High-----	High-----	Low.
Mo----- Moshannon	B	Occasional-----	4.0-6.0	Apparent	Feb-Mar	>60	---	High-----	Low-----	Moderate.
OtA, OtB, OtC----- Otwell	C	None-----	2.0-3.5	Perched	Jan-Apr	>60	---	High-----	Moderate	High.
Sn----- Sensabaugh	B	Occasional-----	4.0-6.0	Apparent	Jan-Apr	>60	---	Moderate	Low-----	Low.
Ta----- Taggart	C	None-----	1.0-3.0	Apparent	Jan-Apr	>60	---	High-----	High-----	High.
UpC----- Upshur	D	None-----	>6.0	---	---	40-60	Soft	Moderate	High-----	Moderate.
VaD, VbD----- Vandalia	D	None-----	4.0-6.0	Perched	Feb-Apr	>60	---	Moderate	High-----	Moderate.
WhA, WhB----- Wheeling	B	None-----	>6.0	---	---	>60	---	Moderate	Low-----	Moderate.
WnB*: Wheeling	B	None-----	>6.0	---	---	>60	---	Moderate	Low-----	Moderate.
Urban land										
WoC----- Woodsfield	C	None-----	>6.0	---	---	40-72	Soft	Moderate	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Ashton-----	Fine-silty, mixed, mesic Mollic HapludalFs
Cedarcreek-----	Loamy-skeletal, mixed, acid, mesic Typic Udorthents
Chagrin-----	Fine-loamy, mixed, mesic Dystric Fluventic Eutrochrepts
Duncannon-----	Coarse-silty, mixed, mesic Ultic HapludalFs
Gallia-----	Fine-loamy, siliceous, mesic Typic PaleudalFs
Gilpin-----	Fine-loamy, mixed, mesic Typic Hapludults
Glenford-----	Fine-silty, mixed, mesic Aquic HapludalFs
Hackers-----	Fine-silty, mixed, mesic Typic HapludalFs
Huntington-----	Fine-silty, mixed, mesic Fluventic Hapludolls
Lakin-----	Mixed, mesic Alfic Udipsamments
Licking-----	Fine, mixed, mesic Aquic HapludalFs
Lindside-----	Fine-silty, mixed, mesic Fluvaquentic Eutrochrepts
Melvin-----	Fine-silty, mixed, nonacid, mesic Typic Fluvaquents
Moshannon-----	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
Otwell-----	Fine-silty, mixed, mesic Typic FragiudalFs
Sensabaugh-----	Fine-loamy, mixed, mesic Dystric Fluventic Eutrochrepts
Taggart-----	Fine-silty, mixed, mesic Aeris OchraqualFs
Upshur-----	Fine, mixed, mesic Typic HapludalFs
Vandalia-----	Fine, mixed, mesic Typic HapludalFs
Wheeling-----	Fine-loamy, mixed, mesic Ultic HapludalFs
Woodsfield-----	Fine, mixed, mesic Typic HapludalFs

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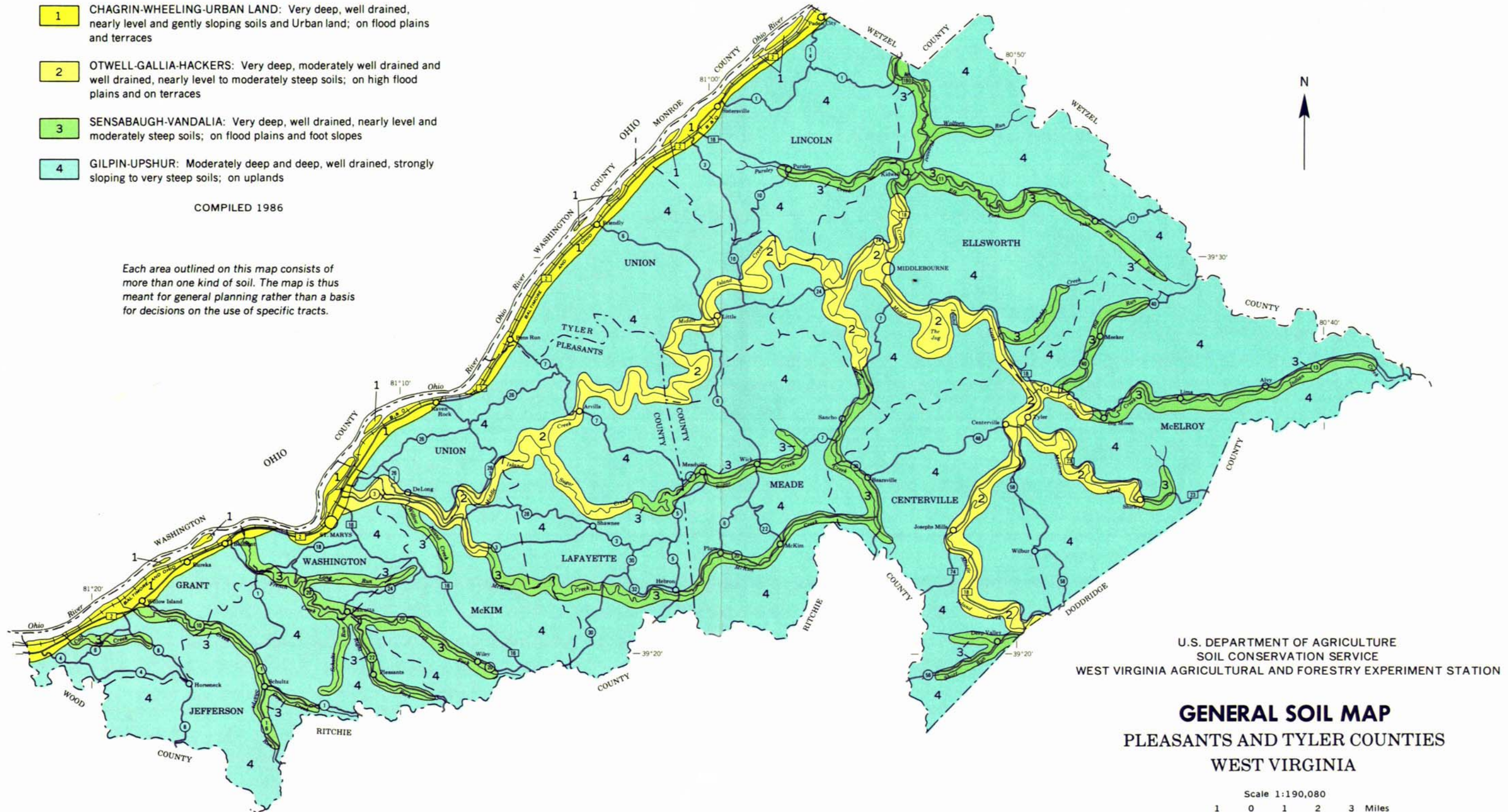
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LEGEND

- 1 CHAGRIN-WHEELING-URBAN LAND: Very deep, well drained, nearly level and gently sloping soils and Urban land; on flood plains and terraces
- 2 OTWELL-GALLIA-HACKERS: Very deep, moderately well drained and well drained, nearly level to moderately steep soils; on high flood plains and on terraces
- 3 SENSABAUGH-VANDALIA: Very deep, well drained, nearly level and moderately steep soils; on flood plains and foot slopes
- 4 GILPIN-UPSHUR: Moderately deep and deep, well drained, strongly sloping to very steep soils; on uplands

COMPILED 1986

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

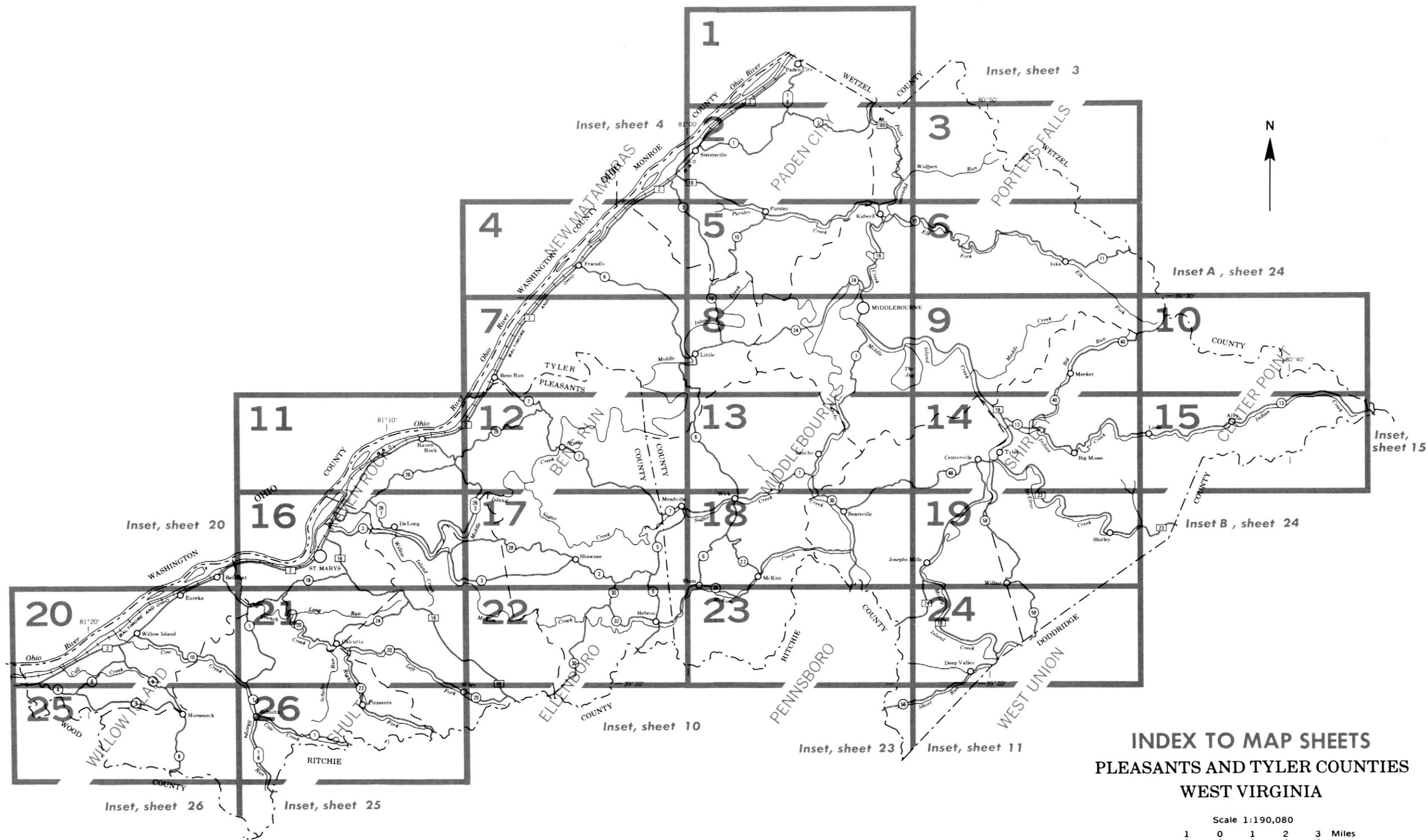


U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WEST VIRGINIA AGRICULTURAL AND FORESTRY EXPERIMENT STATION

GENERAL SOIL MAP PLEASANTS AND TYLER COUNTIES WEST VIRGINIA

Scale 1:190,080





SOIL LEGEND

Publication symbols consist of letters or a combination of letters and numbers (e.g., Cg., GpD, or GwE3). The first letter, always a capital, is the initial letter of the soil name. The lower case letter that follows separates map units having names that begin with the same letter, except that it does not separate slope phases. The third letter, always a capital A, B, C, D, E, or F indicates the slope phase. Symbols without a slope letter are for nearly level soils. The number 3 following a capital letter in the symbol indicates the soil is severely eroded.

SYMBOL	NAME
AsA	Ashton silt loam, 0 to 3 percent slopes
AsB	Ashton silt loam, 3 to 8 percent slopes
CeE	Cedarcreek channery silt loam, steep, stony
Cg	Chagrin loam
DuC	Duncannon silt loam, 8 to 15 percent slopes
DuD	Duncannon silt loam, 15 to 25 percent slopes
GaC	Gallia silt loam, 8 to 15 percent slopes
GaD	Gallia silt loam, 15 to 25 percent slopes
GpC	Gilpin-Upshur complex, 8 to 15 percent slopes
GpD	Gilpin-Upshur complex, 15 to 25 percent slopes
GpE	Gilpin-Upshur complex, 25 to 35 percent slopes
GpF	Gilpin-Upshur complex, 35 to 70 percent slopes
GwC3	Gilpin-Upshur complex, 8 to 15 percent slopes, severely eroded
GwD3	Gilpin-Upshur complex, 15 to 25 percent slopes, severely eroded
GwE3	Gilpin-Upshur complex, 25 to 35 percent slopes, severely eroded
GxF	Gilpin-upshur-Rock outcrop complex, 35 to 70 percent slopes
Gy	Glenford silt loam
HaA	Hackers silt loam, 0 to 3 percent slopes
HaB	Hackers silt loam, 3 to 8 percent slopes
Hn	Huntington silt loam
LaC	Lakin loamy fine sand, 8 to 15 percent slopes
LkC	Licking silt loam, 8 to 15 percent slopes
Ln	Lindside silt loam
Me	Melvin silt loam
Mo	Moshannon silt loam
OtA	Otwell silt loam, 0 to 3 percent slopes
OtB	Otwell silt loam, 3 to 8 percent slopes
OtC	Otwell silt loam, 8 to 15 percent slopes
Sn	Sensabaugh silt loam
Ta	Taggart silt loam
UpC	Upshur silty clay loam, 8 to 15 percent slopes
VaD	Vandalia silt loam, 15 to 25 percent slopes
VbD	Vandalia silt loam, 15 to 25 percent slopes, very stony
WhA	Wheeling silt loam, 0 to 3 percent slopes
WhB	Wheeling silt loam, 3 to 8 percent slopes
WnB	Wheeling-Urban land complex, 0 to 8 percent slopes
WoC	Woodsfield silt loam, 3 to 15 percent slopes
W	Water

CONVENTIONAL AND SPECIAL
SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

National, state or province	
County or parish	
Minor civil division	
Reservation (national forest or park, state forest or park, and large airport)	
Land grant	
Limit of soil survey (label)	
Field sheet matchline and neatline	

AD HOC BOUNDARY (label)

Small airport, airfield, park, oilfield, cemetery, or flood pool	
--	--

STATE COORDINATE TICK

LAND DIVISION CORNER (sections and land grants)	
---	--

ROADS

Divided (median shown if scale permits)	
Other roads	
Trail	

ROAD EMBLEM & DESIGNATIONS

Interstate	
Federal	
State	
County, farm or ranch	

RAILROAD

POWER TRANSMISSION LINE (normally not shown)	
--	--

PIPE LINE (normally not shown)	
--------------------------------	--

FENCE (normally not shown)	
----------------------------	--

LEVEES

Without road	
With road	
With railroad	

DAMS

Large (to scale)	
Medium or Small	

PITS

Gravel pit	
Mine or quarry	

MISCELLANEOUS CULTURAL FEATURES

Farmstead, house (omit in urban areas)	
Church	
School	
Indian mound (label)	
Located object (label)	
Tank (label)	
Wells, oil or gas	
Windmill	
Kitchen midden	

WATER FEATURES

DRAINAGE

Perennial, double line	
Perennial, single line	
Unclassified	
Drainage end	
Canals or ditches	
Double-line (label)	
Drainage and/or irrigation	

LAKES, PONDS AND RESERVOIRS

Perennial	
Intermittent	

MISCELLANEOUS WATER FEATURES

Marsh or swamp	
Spring	
Well, artesian	
Well, irrigation	
Wet spot	

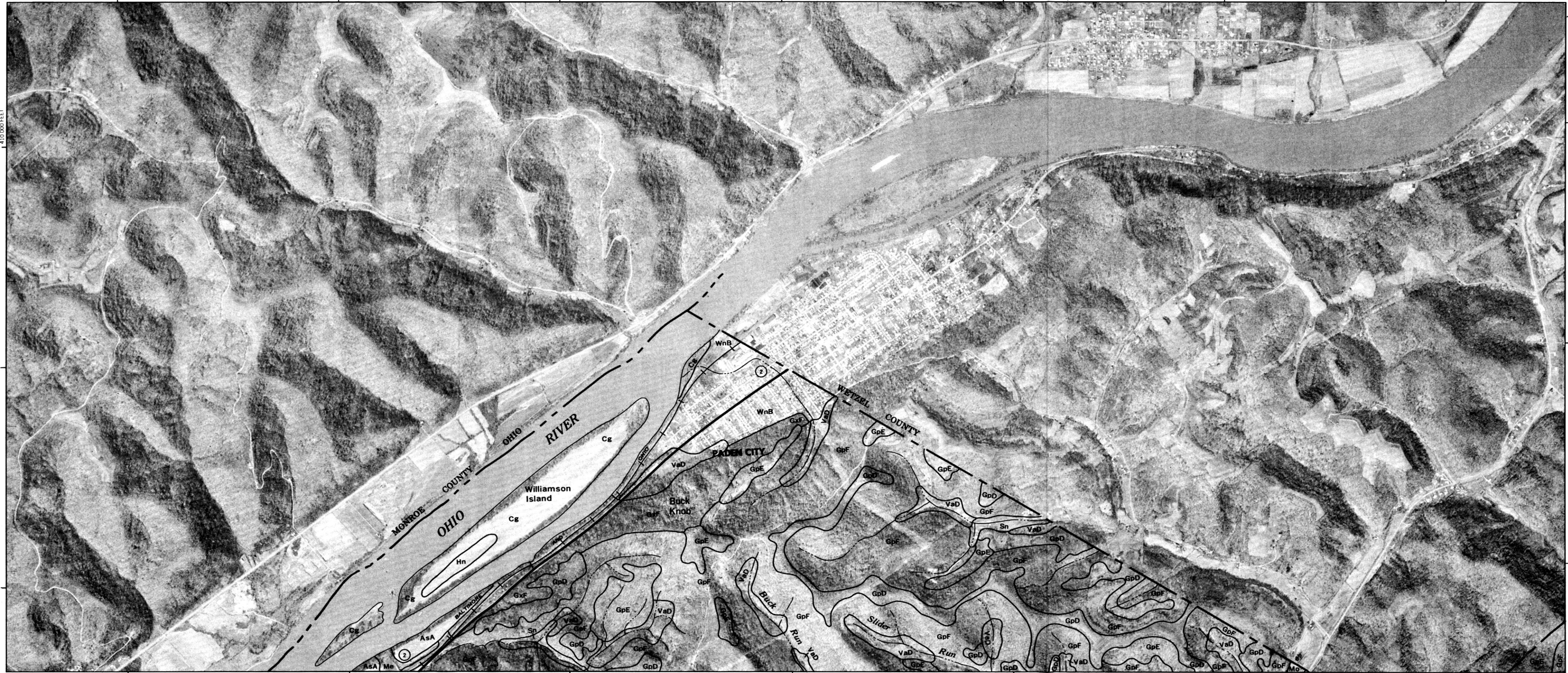
SPECIAL SYMBOLS FOR
SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

WhA	Ta
Escarpments	
Bedrock (points down slope)	
Other than bedrock (points down slope)	
Short steep slope	
Gully	
Depression or sink	
Soil sample (normally not shown)	
Miscellaneous	
Blowout	
Clay spot	
Gravelly spot	
Gumbo, slick or scabby spot (sodic)	
Dumps and other similar non soil areas	
Prominent hill or peak	
Rock outcrop (includes sandstone and shale)	
Saline spot	
Sandy spot	
Severely eroded spot	
Slide or slip (tips point upslope)	
Stony spot, very stony spot	

This map is compiled on 1976 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.

Coordinate grid ticks and land division corners, if shown, are approximately positioned.



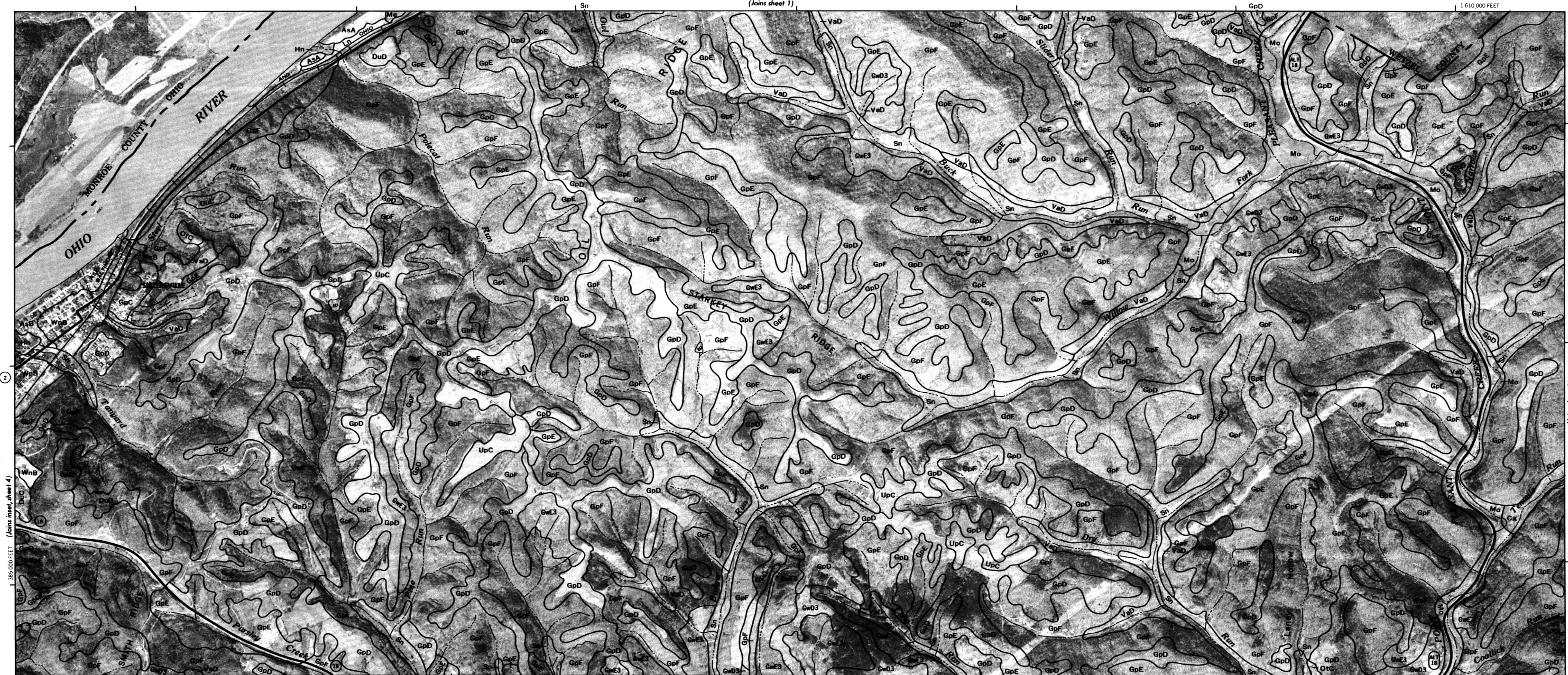
Scale 1:20,000

(Joins sheet 2)



Scale 1:20,000

(Joins inset, sheet 4)



1 580 000 FEET

(Joins sheet 5)

GpD

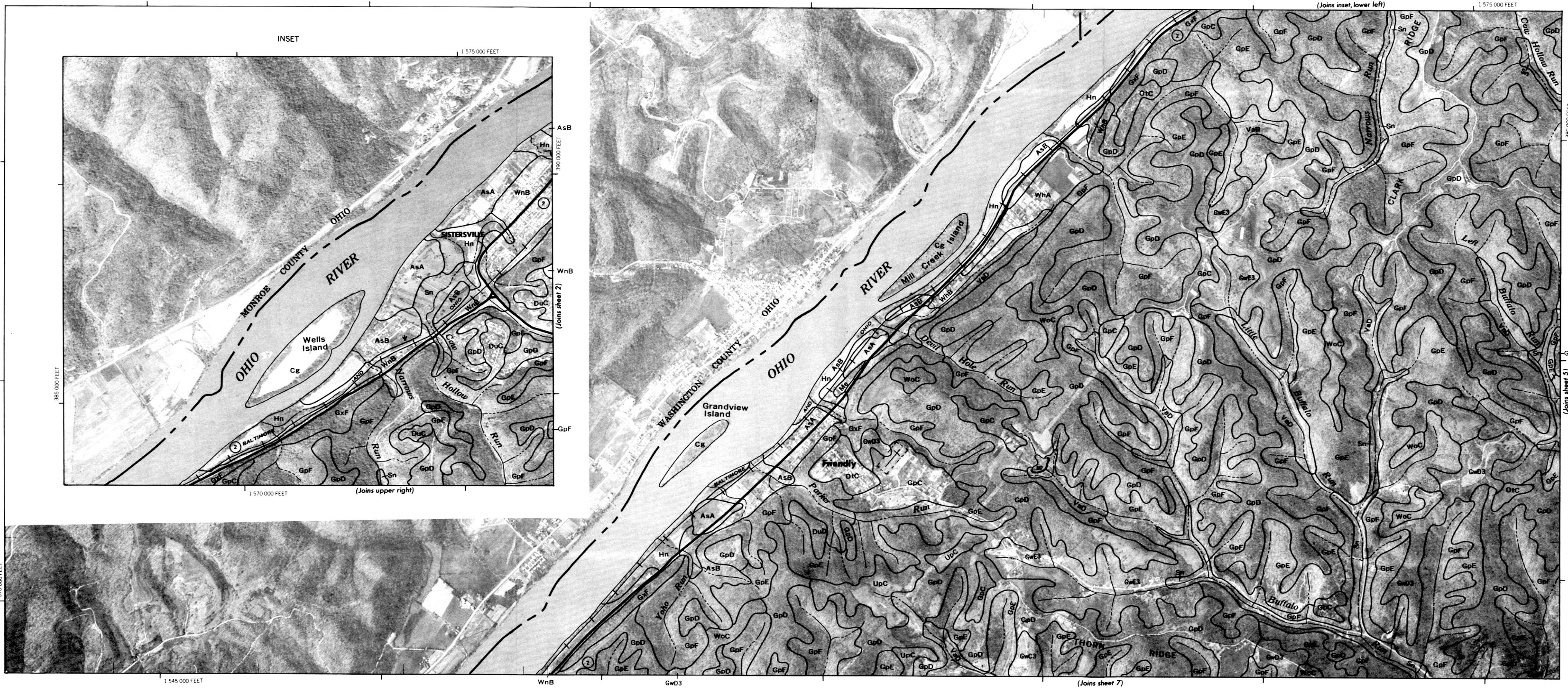
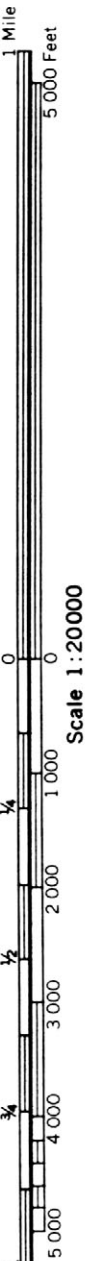
GwD3

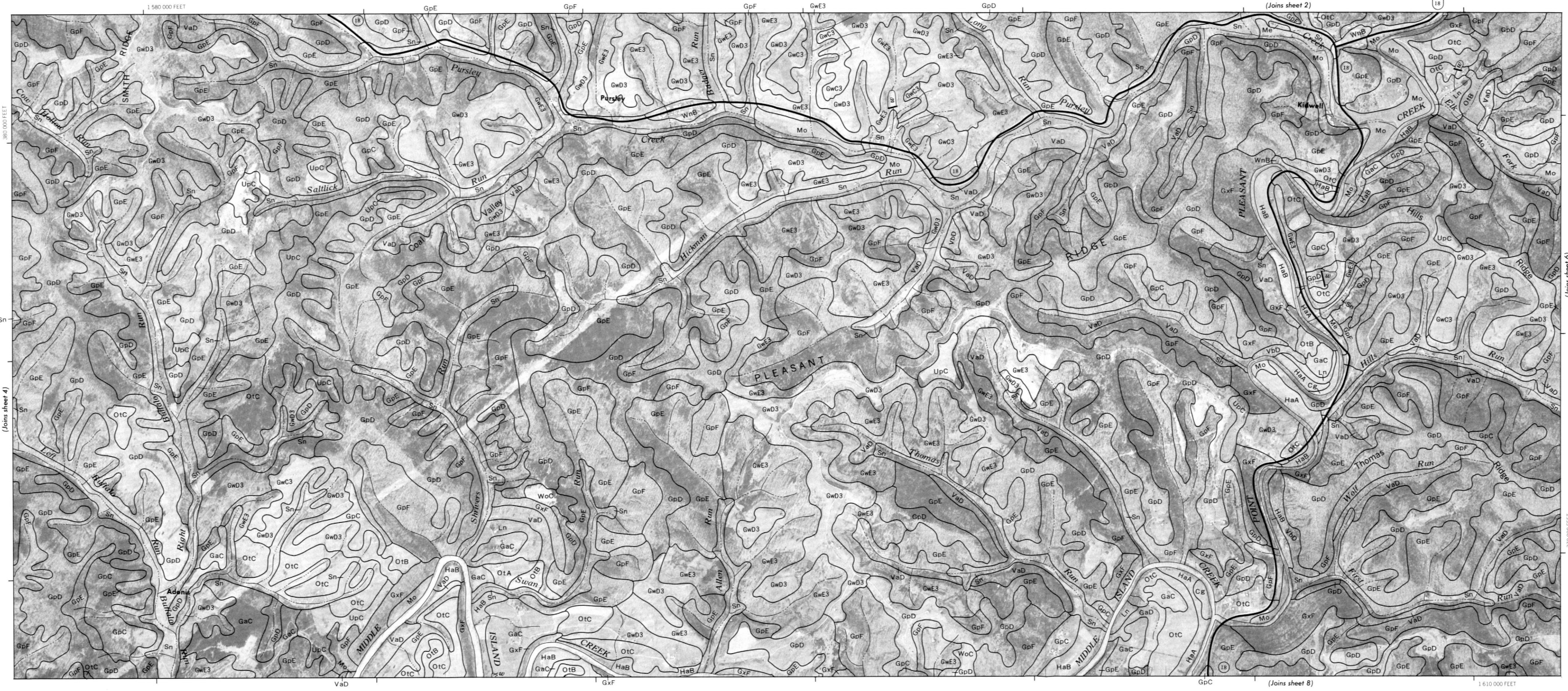
1 610 000 FEET

(Joins sheet 3)

395 000 FEET







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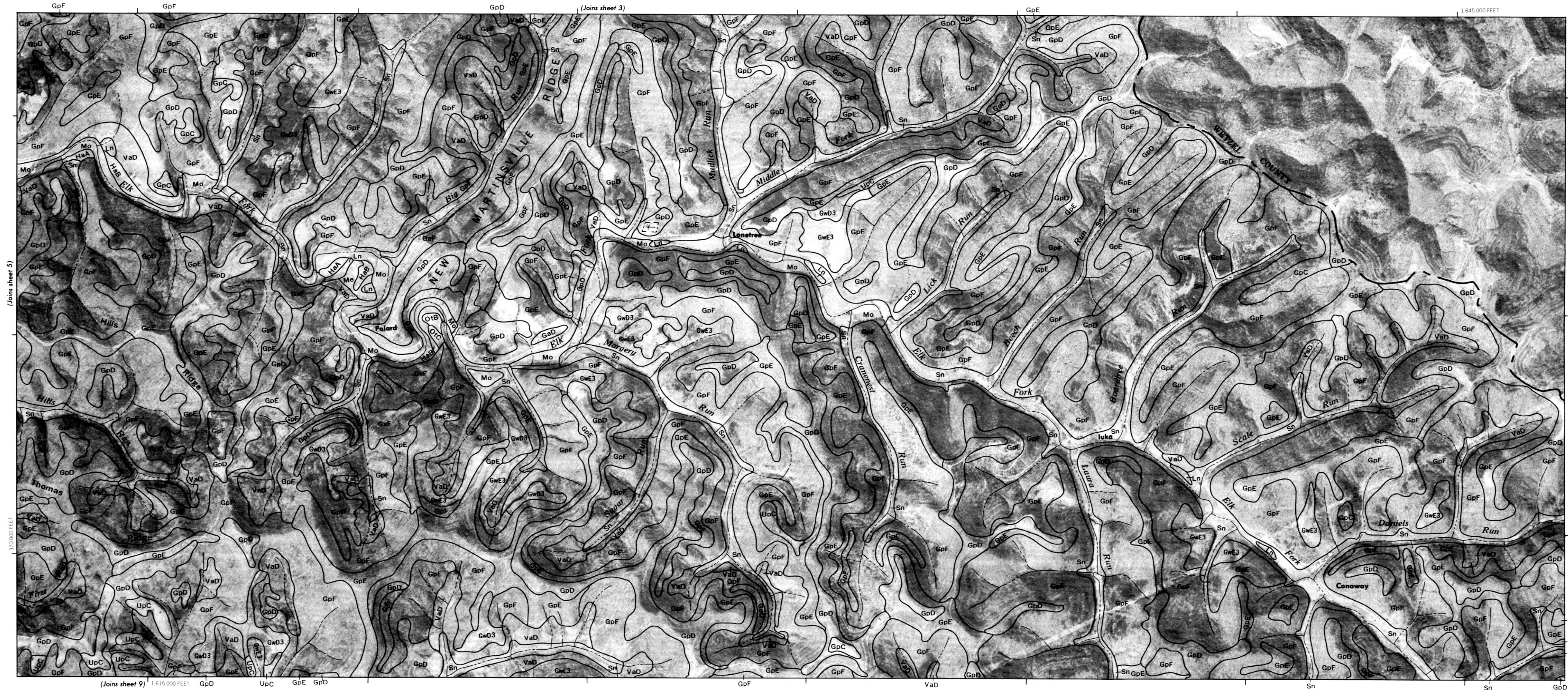


PLEASANTS AND TYLER COUNTIES, WEST VIRGINIA — SHEET NUMBER 6

Mile
5 000 Feet

Scale 1:20000

1 2 3 4 5
0 1 000 2 000 3 000 4 000 5 000
Feet



380 000 FEET

(Joins inset A, sheet 24)



Scale 1:20000



1 Mile
5 000 Feet

(Joins sheet 7)

Scale 1:20 000

0 1 000 2 000 3 000 4 000 5 000
365 000 FEET

OtA

1 580 000 FEET (Joins sheet 13)

GxF

HaB

GpE

1 610 000 FEET

365 000 FEET

(Joins sheet 9)



Scale 1:20000



1 Mile
5 000 Feet

(Joins sheet 9)

Scale 1:20 000

0 1 000 2 000 3 000 4 000 5 000
3/4 1/2 1/4

350 000 FEET

VaD

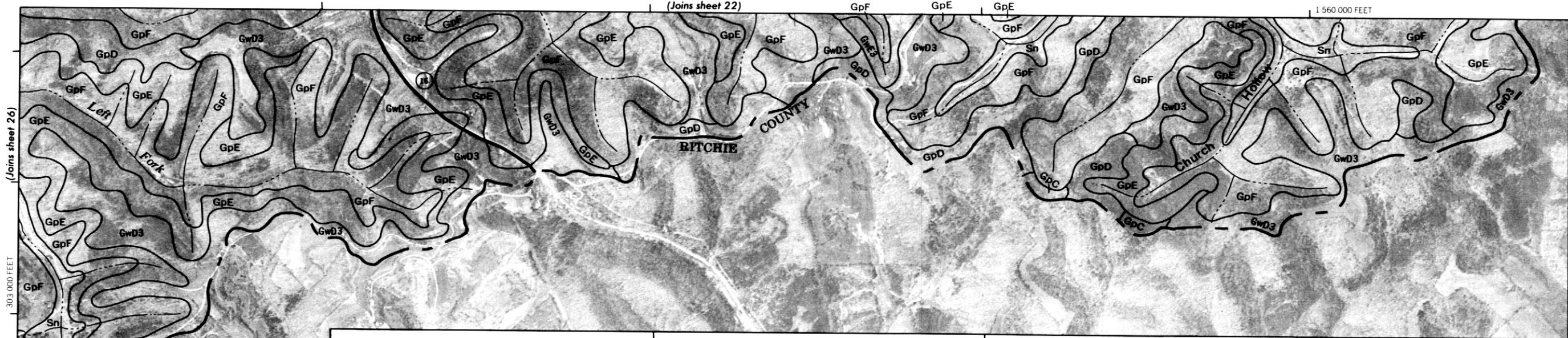


(Joins sheet 15)

(Joins sheet 26)

303 000 FEET

1 545 000 FEET



INSET

(Joins sheet 22)

1 560 000 FEET

307 000 FEET

365 000 FEET

2000 AND 5000-FOOT GRID TICKS





1 Mile
5 000 Feet

(Joins sheet 11)

Scale 1:20 000

0 1 000 2 000 3 000 4 000 5 000
Feet

1:40 000 FEET

(Joins sheet 17)



1:575 000 FEET

(Joins sheet 13)



This map is compiled on 1976 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



(Joins sheet 9)

18

DuC GpD VaD

1 645 000 FEET

1 Mile
5 000 Feet

Scale 1:20 000

(Joins sheet 13)



340 000 FEET

VaD

GwE3

1 615 000 FEET

(Joins sheet 19)

18

GxF

VaD

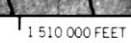
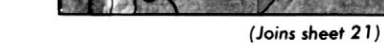
(Joins sheet 15)

350 000 FEET



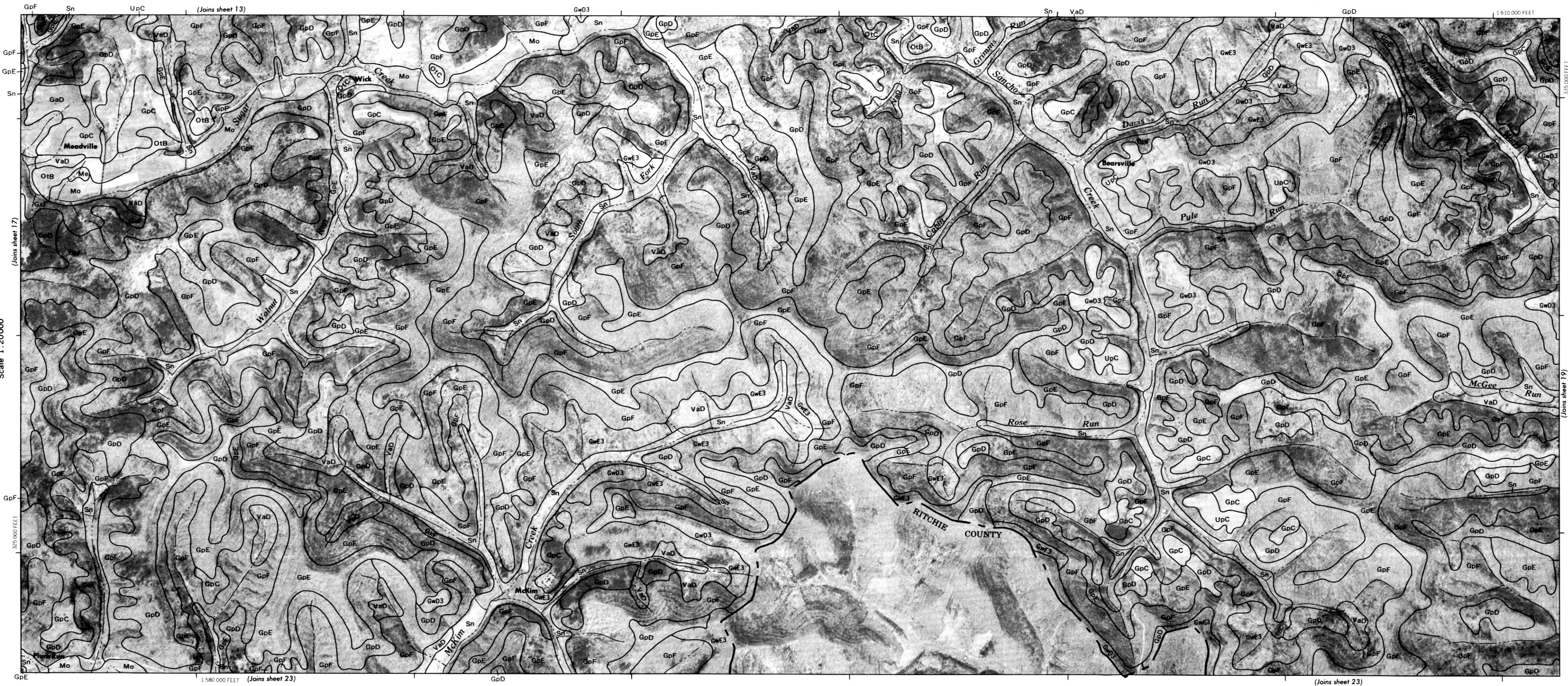
Scale 1:20000

1 680 000 FEET

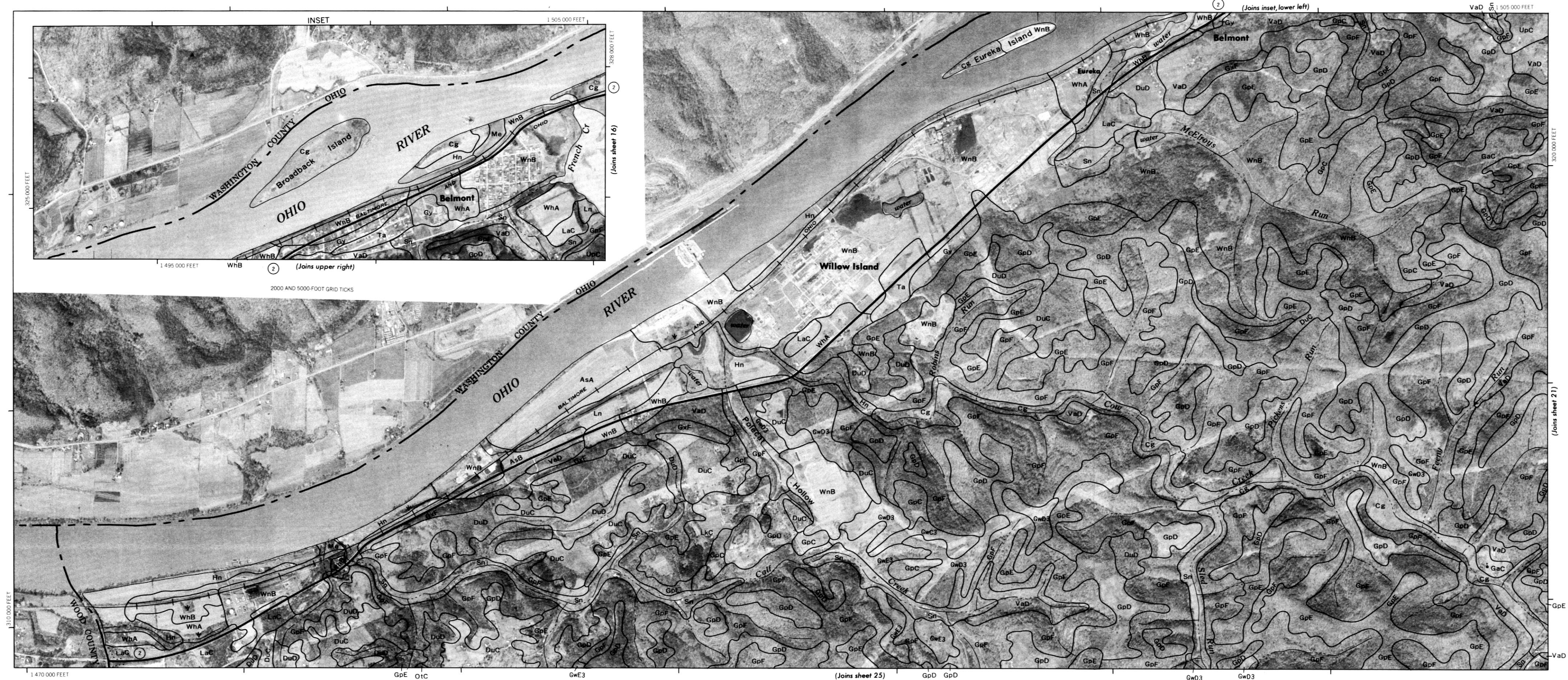
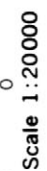
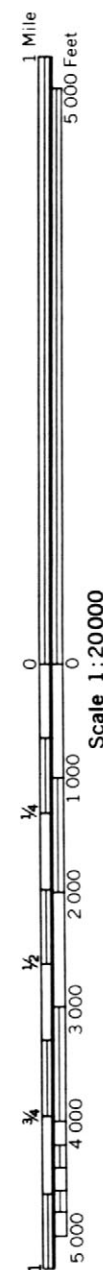




PLEASANTS AND TYLER COUNTIES, WEST VIRGINIA — SHEET NUMBER 18









320 000 FEET

1 510 000 FEET

GwD3 GpE

(16)

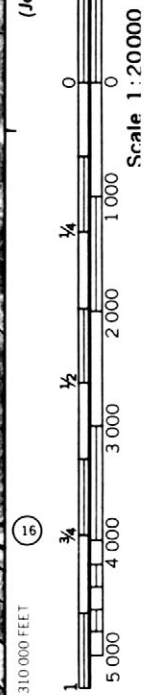
(Joins sheet 16)

(Joins sheet 20)

(Joins sheet 22)

(16)

310 000 FEET



(Joins sheet 26)

1 540 000 FEET

Sn

GpF

GpE

GpD

GpE

GwE3

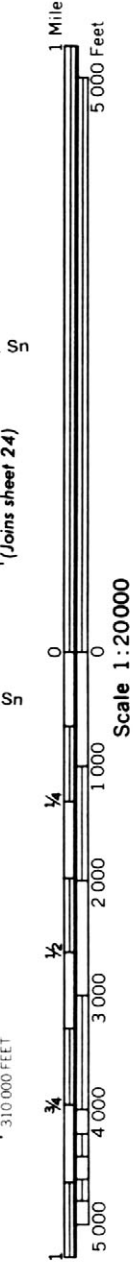
GpF

GpF

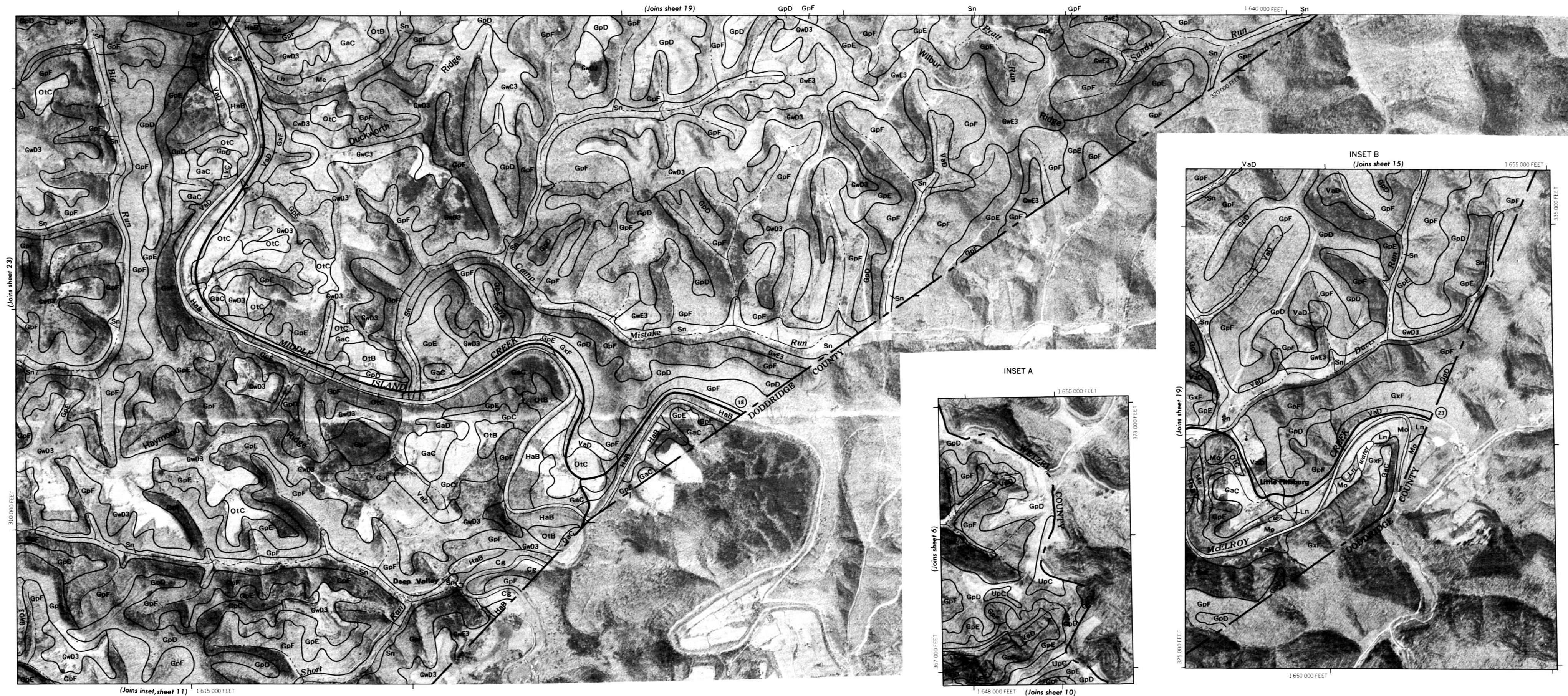
This map is compiled on 1976 U.S. Geological Survey Orthophotography by the U.S. Department of Agriculture. Soil Conservation Service and cooperating agencies. Coordinate grid lines and land division corners, if shown, are approximately featured.



INSET



(Joins sheet 19)



2000 AND 3000-FOOT GRID TICKS

